ENVIRONMENTAL ASSESSMENT

for ongoing and future operations at

U.S. Navy Dabob Bay and Hood Canal Military Operating Areas

May 2002

Prepared for:
Engineering Field Activity, Northwest
Naval Facilities Engineering Command

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U.S. Navy Dabob Bay and Hood Canal Military Operating Areas

May 2002

Prepared for:
Engineering Field Activity, Northwest
Naval Facilities Engineering Command
19917 - 7th Avenue Northeast
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Under contract to:
MAKERS
Seattle, Washington

DEPARTMENT OF THE NAVY

NAVAL SEA SYSTEMS COMMAND
1333 ISAAC HULL AVE SE
WASHINGTON NAVY YARD DC 20376-0001

IN REPLY TO

5090
Ser 00T/166
11 JUN 2002

From: Commander, Naval Sea Systems Command
To: Commander, Naval Undersea Warfare Center Division Keyport

Subj: FINDING OF NO SIGNIFICANT IMPACT FOR ONGOING AND FUTURE OPERATIONS AT U.S. NAVY DABOB BAY AND HOOD CANAL MILITARY OPERATING AREAS, WASHINGTON

Ref: (a) OPNAVINST 5090.1B, Change 2

Encl: (1) Finding of No Significant Impact (FONSI)

1. An Environmental Assessment (EA) for the subject action was forwarded for review in accordance with reference (a). It has been determined that preparation of an Environmental Impact Statement (EIS) is not required. Accordingly, it is considered that, with implementation of the following paragraph and the mitigation measures described in enclosure (1), compliance with the National Environmental Policy Act has been effected and, in this regard, the project may be initiated.

2. The Council on Environmental Quality regulations require public notification of the availability of the EA and of the decision not to prepare an EIS. Enclosure (1) should be provided to local newspapers for publication and mailed to interested parties. Please provide verification of local newspaper publication to NAVSEA 00TP upon implementation. The EA should be retained in project files for possible future use.

3. Questions regarding this FONSI may be directed to Juliana Prevatt, NAVSEA 00TP, at (202) 781-1794, DSN 326, email PrevattJS@navsea.navy.mil.

Iona E. Evans

Iona E. Evans
By Direction

Subj: FINDING OF NO SIGNIFICANT IMPACT FOR ONGOING AND FUTURE OPERATIONS AT U.S. NAVY DABOB BAY AND HOOD CANAL MILITARY OPERATING AREAS, WASHINGTON

Copy to:
CNO N456
CINCPACFLT N45A
COMNAVREG NORTHWEST REC Code N451
NUWC Code 22
NUWCDIVKPT Code 8032

DEPARTMENT OF DEFENSE
DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND

FINDING OF NO SIGNIFICANT IMPACT FOR ONGOING AND FUTURE OPERATIONS AT U.S. NAVY DABOB BAY AND HOOD CANAL MILITARY OPERATING AREAS, WASHINGTON

Pursuant to section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969 and the Council on Environmental Quality regulations (40 CFR Parts 1500-1508) implementing the procedural provisions of NEPA, the Naval Sea Systems Command (NAVSEA) of the Department of the Navy gives notice that an Environmental Assessment (EA) has been prepared for the proposed action of implementing an Operations Management Plan for ongoing and future operations at the U.S. Navy Dabob Bay and Hood Canal Military Operating Areas (MOAs) and connecting waters in the State of Washington. Based on the EA it has been determined that an Environmental Impact Statement (EIS) is not required for the proposed action.

The Navy uses the Dabob Bay MOA and Hood Canal MOAs for in-water testing programs of underwater systems such as torpedoes, countermeasures, targets, and ship systems. The in-water testing programs include those for (1) research and experimental programs, involving evaluating the operational capabilities of experimental units such as torpedoes, targets, and countermeasure systems; (2) proofing, involving production acceptance tests in support of torpedo procurements to ensure that units meet all performance specifications; (3) Fleet operations tests to assess the combat readiness of a vessel, system and/or personnel involving aircraft, surface ships, and submarines; and (4) other operations testing, including unique, non-repeated functions that are similar in scope and function to standard range operations and tests in support of other Federal agencies.

The Dabob Bay MOA is the principal range for in-water testing of torpedoes, and is instrumented with acoustic monitoring equipment installed on the seafloor to provide acoustic tracking during tests. Because of the ability to track objects acoustically, the Dabob Bay MOA is used for a variety of testing other than torpedo testing, including submarine testing and non-Navy instrumentation testing for other agencies. The Hood Canal MOAs are used to conduct tests that determine vessel sensor accuracy, special torpedo launches/recoveries, and for simple, short duration tests not requiring tracking. In the course of operations in the MOAs, various combinations of aircraft, submarines, and surface ships are used as launch platforms. No testing of explosive warheads occurs. Vessels involved in operations occurring in the MOAs transit the connecting waters between the Dabob Bay and Hood Canal MOAs.

Environmental planning responsibilities for test operations in the Dabob Bay and Hood Canal MOAs have heretofore been the responsibility of the offices/activities proposing to conduct the testing. These individual offices and activities have conducted their own independent environmental reviews of their activities, and developed rigorous procedures to be followed during their testing. The scope, number, type and intensity of the testing conducted on the MOAs has varied widely over the years. The current intensity of operations is much lower now than it has been in the past. The Navy does not foresee a return to the previous higher level of operations, although the technology to be tested in the MOAs will in some respects be different from that used in the past. This environmental assessment addresses in a comprehensive manner the anticipated testing activities in the MOAs and in the connecting waters for the foreseeable future.

Future Navy activities in the MOAs will include more extensive testing on a regular basis of Unmanned Underwater Vehicles (UUVs). The proposed testing of the UUVs would require the use of the connecting waters between the Dabob Bay and Hood Canal MOAs, which have previously only been used for transiting vessels as part of testing operations. The proposed UUV testing would involve UUVs transiting the connecting waters underwater at a speed and depth that does not represent a threat of collision to surface craft. The tests would be monitored in transit between the MOAs, as well as on the MOAs themselves.

To define the scope and intensity of operations in the Dabob and Hood Canal MOAs and the use of connecting waters, including future UUV testing, and the environmental consequences of these operations, the Navy under the proposed action would adopt and implement an Operations and Management Plan (OMP). A Draft OMP was included in the EA and a Final OMP will be promulgated at a later date. The Draft OMP, included in the EA, provides a comprehensive description of the testing activities to be conducted in the MOAs and connecting waters, including the level of testing intensity and a definition of the overall operational tempo. Specifically, the OMP identifies that operations would consist of approximately 65 percent research and experimental testing, 15 percent proofing, 15 percent Fleet operations, and 5 percent of other testing. The OMP also specifically identifies that testing activities associated with these operations would include up to 285 launches of test units per year from range support vessels, Fleet vessels, and aircraft; approximately 470 tests of underwater vehicle systems per year, including 270 tests involving thermal propulsion systems and electric systems of which 60 tests would involve UUVs, 150 tests involving other underwater systems, and 50 tests of Fleet operation systems; and approximately 285 retrievals and recoveries of test units. Under the OMP, no testing of explosive warheads would occur.

Alternatives evaluated in the EA for adopting and implementing an OMP included: (1) the Preferred, or Dabob Bay Range Complex, Alternative under which in-water testing operations contained in the OMP would be conducted in the Dabob Bay and Hood Canal MOAs. The connecting waters between the Dabob Bay and Hood Canal MOAs would continue to be transited by vessels, and UUVs as part of future testing; 2) the Dabob Bay Limited Alternative, under which OMP in-water operations would be limited only to the Dabob Bay MOA; and the No Action Alternative, or status quo, under which an OMP would not be implemented and continued testing of a variety of programs would occur but without an overarching OMP and environmental analysis.

The EA concludes that no significant impacts to water quality, hydrological resources, or marine sediments will occur from the proposed action and Preferred Alternative. Although small amounts of exhaust gas will be discharged into the water, and there will be infrequent accidental releases of fuel oil, and very infrequent spills of propellant, mixing and dispersal will reduce the concentrations to well below toxic levels. Water quality samples, collected on the surface and off the bottom of Dabob Bay, and surface sediment samples collected on the bottom of Dabob Bay indicate that analyzed metals (Cd, Cu, Pd, Zn, Li, and Zr) are not present at elevated levels. Metal concentrations observed are at low levels comparable to background levels present in the non-urban portion of Puget Sound, and are below Washington State water quality criteria and sediment quality standards.

The EA notes that activities associated with testing operations under the proposed action and Preferred Alternative will emit intermittent and low levels of emissions into the air. The principal source of emissions will be from the use of vessels and aircraft in testing operations. Although portions of Puget Sound are located in a maintenance area for ozone, testing operations will occur in areas that are in attainment for all National Ambient Air Quality Standard pollutants. Performance of an air quality conformity review under the General Conformity Rule is therefore not required.

The EA shows that no direct physical impacts to subtidal or intertidal fish habitats, or to habitats of marine flora or invertebrates will result from the proposed action and Preferred Alternative, as no new shoreline construction will occur and no significant impacts to water and sediment quality will occur that will affect these resources. Although recovery operations for torpedoes will result in temporary and local turbidity increases, the increases are not expected to adversely affect marine flora, as the great majority of recoveries will occur in the deep waters of Dabob Bay. The EA further concludes that no significant impacts will occur to essential fish habitat, including groundfish present in Dabob Bay and/or northern Hood Canal. The National Marine Fisheries Service (NMFS) has concurred in this determination, and indicated that the effects of the proposed action and Preferred Alternative are transient, local, and of low intensity so as not likely to adversely affect essential fish habitat in the long-term.

The EA also concludes that acoustic emissions associated with testing operations will also not significantly impact fish resources outside the immediate area of the emission (18 and 24 m) as most of the acoustic emissions will not be continuous, and the level of emissions produced will be limited to that which has been shown to produce only fish avoidance reactions. In the unlikely case that fish are within in closer proximity to the source of acoustic emission, fish will be very unlikely to remain the length of time to sustain any injury.

The EA indicates that prior to all tests under the proposed action and Preferred Alternative, the Navy will conduct marine mammal surveys using trained observers to ensure that no large marine mammals are in the vicinity of the testing, and that no harbor seals are within 100 yards of the test area. Gray whales and killer whales are the cetaceans most likely to visit the testing area, however these visits are uncommon. Testing of systems that generate an electromagnetic field (EMF) will occur only about 10 times per year, and the EMF generated is weak and attenuates rapidly. Because gray whales and killer whales are uncommon visitors in the testing area and the Navy will conduct surveys prior to conducting testing operations, no takings of marine mammals, including harm or harassment under the Marine Mammal Protection Act (MMPA), will occur.

The EA identifies that Federally designated threatened or endangered wildlife species potentially occurring in the project area include the Puget Sound chinook salmon, Hood Canal summer-run chum salmon, coastal Puget Sound bull trout, humpback whale, Steller sea lion, marbled murrelet, and bald eagle. To ensure the protection of nesting bald eagles and foraging marbled murrelets from disturbance by helicopters or fixed-wing aircraft during testing operations the following flight rule mitigation measures will be implemented:

- For rotary wing aircraft operations general flight rules will include:
  - Flights over land must be at least 1,000 (304 m) feet above the level of the land;
  - Flights over water must be at least 500 feet (152 m) above the level of the sea;
  - Flights must maintain a 656 foot (200 m) lateral no-fly area around bald eagle nests; and
  - Flights within 500 yards (457 m) of the shore (beach) must be at least 1,000 feet (304 m) above sea level.

  Exceptions to these rules include:

  - Landing/takeoff of rotary wing aircraft at Zelatched Point within landing constraints;
  - Launch of weapons or vehicles over the range area; and
  - Retrieval of weapons or vehicles over the range area.
  - Landing/takeoff constraints:
  - Approach and departure from Zelatched Point helipad will not be from an overland direction (generally easterly or southerly direction); and
  - The approach will be from an over water direction roughly parallel to the shoreline with the exact approach direction dictated by the current wind conditions.

- For fixed-wing aircraft operations general flight rules will include:

  - Flights over land must be at least 1,000 feet (304 m) above the level of the land;
  - Flights over water must be at least 500 feet (152 m) above the level of the sea;
  - Flights must maintain a 656 foot (200 m) lateral no-fly zone around bald eagle nests; and
  - Flights within 500 yards (457 m) of the shore (beach) must be at least 1,000 feet (304 m) above sea level.

  Exceptions to these rules include:

  - Launch of weapons or vehicles over the range area.
  - Fixed-wing aircraft approaching the range area shall not descend below 500 feet (152 m) for a launch until they are over the military operating area and more than 500 yards (457 m) off the shore (beach). These operations will be generally along the range centerline or in a northerly (011°T or 351°M)/southerly (191°T or 171°M) direction (T-true north, M-magnetic north.

Navy boats used in operational tests will comply with Marine Mammal Protection Action guidelines for approaching or harassing marine mammals. Analyses contained in the EA show that the proposed action and Preferred Alternative will have no effect on the humpback whale and Steller sea lion, and may affect, but is not likely to adversely affect, the bald eagle, marbled murrelet, Puget Sound bull trout, Puget Sound chinook salmon, and Hood Canal summer-run chum salmon. In accordance with section 7(a)(2) of the Endangered Species Act of 1973 the U.S. Fish and Wildlife Service and NMFS have concurred in these determinations.

The EA indicates that no archaeological resources or traditional cultural properties potentially eligible for listing in the National Register of Historic Places (NRHP) have been recorded in the DBRC. Shipwrecks possibly eligible for listing in the NRHP exist in underwater areas of the MOAs and connecting waters. Because no shoreline or groundbreaking activities are a part of the proposed action and Preferred Alternative, there will be no effect to areas of archaeological importance or to Native American traditional cultural use areas. In the unlikely event that Navy actions require bottom-disturbing activities within one mile of a shipwreck, the Navy will consult with the State Historic Preservation Officer.

The proposed action and Preferred Alternative will not have a disproportionately high and adverse human health or environmental effect on minority or low-income communities. The proposed action and Preferred Alternative will also not cause significant adverse impacts to public safety or to the safety of children.

The EA notes that testing operations under the proposed action and Preferred Alternative will occur within the usual and accustomed fishing area of some Native American tribes. Tribes primarily use the Dabob Bay MOA for shellfishing, and Tribes transit Dabob Bay to reach Quilcene Bay for other fisheries. Scheduling of testing has been and will continue to be coordinated with Tribal fishing patterns to ensure that the potential for disruption is minimized. The impact of the proposed action and Preferred Alternative on recreation facilities is expected to be minimal. Operational activities will occur in deep water and not directly along the shoreline where most recreational facilities are located. Operating practice has been and will continue to be to curtail testing operations in Dabob Bay during shrimping season due to the high volume of boaters in the area at that time.

The EA also identifies that the proposed action and Preferred Alternative complies with the State of Washington's Shoreline Management Act (SMA) to the maximum extent practicable. Additionally, the Washington State Department of Ecology has agreed with the determination that the proposed action and Preferred is consistent to the maximum extent practicable with the enforceable policies of Washington's Coastal Zone Management Program.

The EA, prepared by the Navy addressing this action, may be obtained from: Commander, Engineering Field Activity Northwest, Naval Facilities Engineering Command, 19917 7th Avenue N.E., Poulsbo, Washington 98370-7570 to the Attention of Mrs. Kimberly Kler, Code 05EC3.KK, telephone (360) 396-0927. Copies of the EA may also be reviewed at the Kitsap Regional Libraries in Bremerton, Port Orchard, Poulsbo and Silverdale, Washington and Jefferson County Library in Port Hadlock, Washington.

10 June 2002
Date

Iona E Evans
IONA E. EVANS
Director, Environmental
Protection/Occupational
Safety and Health
Naval Sea Systems Command

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER
1176 HOWELL STREET
NEWPORT RI 02841-1708

IN REPLY REFER TO:
5090
Ser NUWC-22/67
07 MAR 02

FIRST ENDORSEMENT ON NAVUNSEAWARCENDIV KEYPORT ltr 5090
Ser 00/122-02 of 28 Jan 02

From: Technical Director, Naval Undersea Warfare Center
To: Commander, Naval Sea Systems Command (SEA 00T)

Subj: ENDORSEMENT OF THE ENVIRONMENTAL ASSESSMENT FOR THE DABOB BAY RANGE COMPLEX AT NAVAL UNDERSEA WARFARE CENTER DIVISION, KEYPORT

Encl: (1) Final Environmental Assessment for on-going and future operations at U.S. Navy Dabob Bay and Hood Canal Military Operating Areas, May 2001

1. Forwarded.

2. The Final Environmental Assessment for the on-going and future operations at the U.S. Navy Dabob Bay and Hood Canal Military Operating Areas located in Hood Canal, Washington State is thorough and complete.

J. E. SIRMALIS

Copy to:
NAVUNSEAWARCENDIV KEYPORT

DEPARTMENT OF THE NAVY
NAVY REGION NORTHWEST
1103 HUNLEY RD.
SILVERDALE, WASHINGTON 98315-1103

5090
Ser N45/ 1005
5 Jul 01

From: Commander, Navy Region Northwest
To: Commander, Naval Undersea Warfare Center Division Keyport

Subj: ENVIRONMENTAL ASSESSMENT FOR DABOB BAY RANGE COMPLEX AT NUWC DIVISION KEYPORT

Ref: (a) COMNUWC KEYPORT ltr 5090 Ser 802/199-01 of JUN 01 2001

1. Reference (a) forwarded the Final Environmental Assessment (EA) for Dabob Bay Range Complex (ongoing and future operations analysis) at the Naval Undersea Warfare Center Division, Keyport.

2. Navy Region Northwest has completed its EA review and concurs with your recommendation for a "Finding Of No Significant Impact" (FONSI) on the Dabob Bay Range Complex EA, proposing implementation of a Range Management Plan at NUWC Division Keyport. Our concurrence is based on project commitment to carry out mitigation efforts identified in the Environmental Assessment.

3. Navy Region Northwest point of contact is Mr. Ed Lukjanowicz, (360) 315-5410, email address, elukjanowicz@cnrnw.navy.mil.

Robert M. Campagna
R. M. CAMPAGNA
By direction

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 00/122-02
JAN 28 2002

From: Commander, Naval Undersea Warfare Center Division, Keyport
To: Commander, Naval Sea Systems Command (00T)
Via: Commander, Naval Undersea Warfare Center

Subj: ENDORSEMENT OF THE ENVIRONMENTAL ASSESSMENT FOR THE DABOB BAY RANGE COMPLEX AT NUWC DIVISION KEYPORT

Ref: (1) OPNAVINST 5090.1B Change-2, Chapter 2 of 09 SEP 99
(2) CNO N45 ltr 5090 Ser N456/8U595188 of 09 MAR 98

Encl: (1) Final Environmental Assessment for ongoing and future operations at U.S. Navy Dabob Bay and Hood Canal Military Operating Areas, May 2001.

1. This letter endorses the Final Environmental Assessment (EA) for the ongoing and future operations at the U.S. Navy Dabob Bay and Hood Canal Military Operating Areas located in Hood Canal, Washington State. The Military Operating Areas in Hood Canal, also know as the Dabob Bay Range Complex, are used by the Naval Undersea Warfare Center Division, Keyport (NUWCDIVKPT). The EA was conducted to address the environmental effects of implementing a new Range Operations and Management Plan for the Dabob Bay Range Complex and concludes the proposed action will not significantly affect the quality of the human environment. Based on the analysis presented in the Final EA, a recommendation is made for a Finding Of No Significant Impact (FONSI).

2. This EA was created by a team of NUWCDIVKPT and NAVFAC EFA-NW members. It has been reviewed and endorsed by the NUWCDIVKPT Office of General Counsel, Mr. Robert M. Jusko. The Regional Environmental Coordinator for the Navy Region Northwest has also reviewed and provided their concurrence.

3. Point of contact is Mr. Dean Kohn, NUWCDIVKPT Code 802 at (360) 396-2658, DSN 744-2658.

Mary Townsend-Manning
MARY TOWNSEND-MANNING

Copy To: COMNAVREGNW
NAVFAC EFANW

ABSTRACT

The Department of the Navy (Navy) has prepared this Environmental Assessment (EA) to evaluate the potential environmental impacts associated with the adoption and implementation of an Operations and Management Plan (OMP) to regulate testing operations occurring in Dabob Bay and Hood Canal in Kitsap and Jefferson Counties, Washington. The Proposed Action analyzed in this EA is the adoption and implementation of the OMP. A Draft OMP is attached as Appendix A to this EA. The Final OMP will be promulgated after the conclusion of the EA process and Finding of No Significant Impact (FONSI) to incorporate whatever mitigation and protective measures determined to be appropriate. The OMP addresses a range of operations that encompass the existing Dabob Bay Military Operating Area (MOA), the two existing Hood Canal MOAs, and the connecting waters between them. This entire complex of ranges and connecting waters is referred to as the Dabob Bay Range Complex (DBRC). The DBRC is one of the Navy's premier sites for proofing, research, and development of underwater weapons systems such as torpedoes, countermeasures, targets, and ship systems.

The purpose of the OMP for the NUWC Division Keyport testing ranges at Dabob Bay and Hood Canal is to provide clarity to the scope of operations in those ranges and to minimize the environmental impact of those ranges through an improved understanding of the issues involved with their operation. A primary objective is to eliminate the performance of a separate analysis for each individual test. Such separate analyses do not allow for a comprehensive approach, are not conducive to an understanding of potentially important cumulative issues, are an impediment to potential Navy customers, and increase costs.

The Preferred Alternative analyzed in this EA would allow testing at all of the areas of the DBRC. A second alternative – the Dabob Bay Limited Alternative – would be to limit testing to the Dabob Bay MOA only, and would not include the Hood Canal MOAs or the connecting waters. A third option is a No Action Alternative, defined as not adopting the OMP. Thus, the No Action Alternative essentially preserves the status quo, which would allow for continued testing of a variety of programs as they evolve with individual environmental reviews but without a comprehensive operations plan.

This EA presents information on the existing environment, environmental consequences, and mitigation measures associated with each of these three alternatives. Resources examined include water quality and hydrological resources, marine sediments, air quality, marine flora and fauna, terrestrial flora and fauna, threatened and endangered species, cultural resources, land and shoreline use, socioeconomics, recreation, environmental justice, and safety hazards and environmental hazards to children.

Based on the analysis, the Navy has determined that implementation of the Proposed Action would not cause significant impacts to the environment; therefore, preparation of an Environmental Impact Statement (EIS) is not necessary, and a Finding of No Significant Impact (FONSI) is recommended.

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ACRONYMS AND ABBREVIATIONS

ADCAP	Advanced Capacity
AET	Apparent Effects Threshold
BMA	Bottom Moored Array
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFMETR	Canadian Forces Maritime and Experimental Test Ranges
CFR	Code of Federal Regulations
CITES	Convention on International Trade in Endangered Species
dB	decibel
dBA	decibel (A-weighted)
DBRC	Dabob Bay Range Complex
DMMP	Dredged Material Management Program
DO	dissolved oxygen
DoD	Department of Defense
DU	dwelling unit
EA	Environmental Assessment
EDNA	Environmental Designation for Noise Abatement
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FONSI	Finding of No Significant Impact
FR	Federal Register
GMA	Growth Management Act
GPS	global positioning system
GTV	General Test Vehicles
Hz	hertz
IUCN	International Union for Conservation of Nature and Natural Resources
K/B	Keyport/Bangor
kHz	kilohertz
kt	knots
LC	Lethal Concentration
LF	low frequency
MEC	Median Effective Concentration
MK	Mark
MLC	Median Lethal Concentration
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act
MOA	Military Operating Area
msl	mean sea level

ACRONYMS AND ABBREVIATIONS (continued)

mt	metric ton
NASWI	Naval Air Station Whidbey Island
NEPA	National Environmental Policy Act
nm	nautical mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOEC	No Observed Effect Concentration
NRHP	National Register of Historic Places
NUWC	Naval Undersea Warfare Center
OAHP	Office of Archaeology and Historic Preservation
OMP	Operations Management Plan
OSHA	Occupation Safety and Health Administration
P.L.	Public Law
PAH	polycyclic aromatic hydrocarbons
PHS	Priority Habitats and Species
PM-10	particulate matter less than 10 microns in diameter
POC	Point of Contact
ppb	parts per billion
ppm	parts per million
PRST	Trident Post Refit Sea Trial
PSAMP	Puget Sound Ambient Monitoring Program
PSEP	Puget Sound Estuary Program
R&E	Research and Experimental
RMC	Royal Military College
ROC	Record of Communication
ROP	Range Operating Procedures
ROV	Remotely Operated Vehicle
RVC	Rural Village Center
SCEPS	Stored Chemical Energy Propulsion System
SEDQUAL	Sediment Quality Information System
SF	square foot
SHPO	State Historic Preservation Officer
SL	Screening Level
SMS	Sediment Management Standards
SORD	Submerged Object Recovery Device
SQS	Sediment quality standards
SR	State Route
SUBASE	Submarine Base
TCP	Traditional Cultural Properties
TDV	Torpedo Defense Vehicle
TDV	Torpedo Defense Vehicle
TOC	total organic carbon

ACRONYMS AND ABBREVIATIONS (continued)

TOSS	Towed Submarine Simulator
TRB	Torpedo Retrieval Boat
TRB	Torpedo Retrieval Boat
UBC	University of British Columbia
UGA	Urban Growth Area
USACOE	U.S. Army Corps of Engineers
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
UUVs	Unmanned Underwater Vehicles
UV	Ultraviolet
VOC	volatile organic carbon
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDOE	Washington Department of Ecology
WDOH	Washington Department of Health
YP	Yard Patrol
YTT	Yard Torpedo Tender

1.0 INTRODUCTION

The Department of the Navy is evaluating potential environmental impacts associated with the adoption and implementation of an Operations and Management Plan (OMP) for undersea warfare testing operations occurring in Dabob Bay, Hood Canal, and connecting waters in Kitsap and Jefferson Counties, Washington. These tests involve a variety of Naval vessels, aircraft, and submarines and a variety of underwater vehicles' propulsion systems, but do not involve explosive warheads. Explosive warheads are never placed on test units. The impacts are addressed in this Environmental Assessment (EA) pursuant to the requirements of the National Environmental Policy Act (NEPA) of 1969 and subsequent implementing regulations issued by the Council on Environmental Quality (CEQ) (40 CFR Part 1500). The Navy policy is for these reviews to be conducted in a manner consistent with national environmental policies and regulations, including environmental justice (Executive Order 12898) and environmental health hazards to children (Executive Order 13045). This process includes the systematic examination of likely environmental consequences of implementing this proposed action (OPNAVINST 5090.1B CH-2). Conformance with this law is being carried out under the provisions of the Department of the Navy's Environmental and Natural Resources Program Manual (OPNAVINST – 5090.1B CH-2), September 9, 1999. There are two companion documents to this EA: (1) the OMP, which establishes policies and procedures for undersea warfare testing operations, and (2) the Biological Assessment (EDAW 2001) for the OMP, which assesses the impacts of those actions on threatened and endangered species, in accordance with the Endangered Species Act (ESA) (50 CFR Part 402).

1.1 AUTHORITY AND JURISDICTION

This document is intended to meet the statutory requirements of NEPA, as amended by Public Law (P.L.) 91-190, 42 United States Code (USC) 4347. Conformance with this law is being carried out under the provisions of the Department of the Navy's *Environmental and Natural Resources Program Manual* (OPNAVINST – 5090.1B, CH-2, September 9, 1999). As stated in OPNAVINST – 5090. 1B – Chapter 2-5.3.1:

> An EA is an analysis of the potential environmental impact of a proposed action. Action proponents must prepare an EA when they do not know beforehand whether or not the proposed action will significantly affect the human environment or be controversial regarding environmental effects. An EA will either result in a Finding Of No Significant Impact (FONSI), or, if a significant impact is expected, preparation of an Environmental Impact Statement (EIS).

The Department of the Navy must evaluate all reasonable alternatives to determine the significance of potential impacts and the adequacy of proposed mitigation measures. Based on this evaluation, the Department of the Navy will decide whether a FONSI is appropriate or whether the Proposed Action would generate significant impacts, thus requiring preparation of an EIS.

1.2 HISTORY AND BACKGROUND

The Department of the Navy has conducted underwater testing in Puget Sound since 1914, when the Pacific Coast Torpedo Station was established at Keyport. This station has been associated with aspects of virtually all major developments in undersea warfare systems since its operational inception. Now known as the Naval Undersea Warfare Center (NUWC) Division Keyport, it has the mission, organization, facilities, and expertise to support advancements in undersea systems, including the assembly, proofing, testing, and evaluation of these systems as part of their integration into operational Fleet elements. Torpedo testing was originally conducted in Liberty Bay adjacent to Keyport. In addition to the main industrial facilities located in Keyport, NUWC Division Keyport currently operates, or proposes to operate, in four underwater testing areas in Puget Sound. Operations adopted in the OMP that are conducted in these four areas are the subject of this EA. These areas are:

- Dabob Bay Military Operating Area (MOA)– a deep-water range in Jefferson County approximately 8.5 nautical miles (nm) by 2 nm (12 by 3 km) in size with an average depth of 375 feet (114 m). The acoustic tracking area located within the range is approximately 7.25 nm by 1.25 nm (13.5 by 2.3 km).
- Hood Canal MOAs– 2 deep-water operating areas adjacent to Submarine Base (SUBASE) Bangor in Hood Canal, approximately 1 by 4 nm (1.9 by 7.4 km) in size and 350 feet (108 m) deep.
- Connecting Waters - The portion of the Hood Canal that connects the Dabob Bay MOA with the Hood Canal MOAs, along the southern edge of the Toandos Peninsula. The shortest distance between the Dabob Bay MOA and the Hood Canal MOA by water is approximately 3.75 nm (6.9 km).

The Proposed Action analyzed in this EA is the adoption and implementation of the Operations and Management Plan (OMP), which specifies the range of operations that will occur at the existing Dabob Bay MOA, the two existing Hood Canal MOAs, and the connecting waters between them (Appendix A). This entire complex of ranges and connecting waters is hereafter referred to as the Dabob Bay Range Complex (DBRC). The OMP defines the range of operations that occur at the DBRC, including all test types, range locations, test unit propulsion systems, estimated quantities of specific tests, and related delivery and recovery operations. Policy and procedures for range operations are established by other NUWC Division Keyport documents.

The DBRC is the Navy's premier site for proofing, research, and development of underwater systems such as torpedoes, countermeasures, targets, and ship systems. No testing of explosive warheads occurs, or is planned to occur, in the DBRC; explosive warheads are never placed on test units. Primary operations at the DBRC provide production acceptance (proofing) tests of underwater systems, research and development test support, and fleet tactical evaluations involving aircraft, submarines, and surface ships. These tests and evaluations of underwater systems from the first prototype and pre-production stages up through fleet operations (inception to deployment) ensure reliability and availability of underwater systems and their components to the fleet. The site also supports acoustic/magnetic measurement programs. These programs include underwater vehicle/ship noise/magnetic signature recording, radiated sound investigations, and sonar evaluations. In the course of these operations, various combinations of aircraft, submarines, and surface ships are used as launch platforms.

NUWC Division Keyport performs tests for a variety of Navy programs. Testing of torpedo operations began in 1914; testing of acoustic torpedoes began in 1950 with related technological advances. In 1959, NUWC Division Keyport also began testing missile components for the POLARIS program. The first launching of the heavyweight Mark (MK) 48 torpedo took place in 1965, and the MK 48 program is still the most active user of the ranges today. The arrival of the TRIDENT program at SUBASE Bangor in the mid-1970s gave a new dimension to operations at the Dabob Bay and Hood Canal areas.

Much of the activity at the ranges is monitored remotely through sophisticated computer systems using acoustic tracking devices. The first digital underwater tracking of range tests began in 1969. Today all tests are monitored remotely using a variety of sophisticated electronic systems, including global positioning system (GPS) units, underwater hydrophones, and signal relay buoys, among others. Test data are recorded and sent back to various laboratories by way of remote sensing devices. The depth and sheltered, quiet conditions of Hood Canal and Dabob Bay make them ideal locations for acoustically tracked testing of this nature, due to the pristine quality of the water and the relative lack of background noise such as motors. Because of the ability to track objects acoustically, use of the ranges is not limited to torpedo testing but is open to a variety of acoustic testing, including submarine testing and even non-Navy instrumentation testing for other agencies such as the National Oceanic and Atmospheric Administration (NOAA).

Most of the activities analyzed in this EA consist of operations that take place in the waters of Hood Canal and Dabob Bay. Test units are typically carried by boat from SUBASE Bangor on Hood Canal or NUWC Division Keyport on Liberty Bay to the ranges where they are launched, recovered, and returned. Test units are also occasionally launched from aircraft over marine waters or carried overland by truck to Zelatched Point and loaded on helicopters for launching in Dabob Bay. Test units are also routinely transported by truck to Naval Air Station Whidbey Island (NASWI) from NUWC Division Keyport, and to and from SUBASE Bangor by truck as well. All of these operations are analyzed in this document.

1.3 PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the OMP for the NUWC Division Keyport testing ranges at Dabob Bay and Hood Canal is to provide clarity to the scope of operations in those ranges and to minimize any environmental impact of activities at those ranges through an improved understanding of the issues involved with their operation. A primary objective is to eliminate separate environmental analysis for each individual test. Such piecemeal analyses increase costs, limit the scope of each analysis, and are an impediment to potential Navy customers. A holistic review of impacts will provide a more accurate analysis and an increased cost efficiency. Operations at the ranges are currently regulated by several internal Navy documents, most important of those being the Range Operating Procedures (NUWC Division Keyport 1999) and the adopted testing procedures. Although these documents provide a rigorous series of procedures for users to follow in regards to individual test types and identify individual equipment specifications related to tests, they do not define the full scope of testing at the DBRC.

The Navy acknowledges the importance of establishing a projected ceiling of operations for the DBRC to develop a science-based profile of the full impacts of those operations. While in years past, the operational intensity has been much higher than at the present time, the Navy does not foresee a return to that level of operations. The OMP provides a comprehensive description of testing activities at the range area, estimating testing intensity for each type of activity and defining the overall operational tempo. These estimates identify the level of operations analyzed for environmental impacts in this document and are typically higher than the anticipated actual level of operations to evaluate the highest probable level of impact.

While historically operations were limited to the Dabob Bay and Hood Canal MOAs, the Navy proposes to extend the scope of operations at these ranges by running tests involving transiting Unmanned Underwater Vehicles (UUVs) between the MOAs. These tests will transit between the Hood Canal MOAs and the Dabob Bay MOA moving underwater at a speed and depth that does not represent a threat of collision to surface craft. These tests would be monitored in transit between the ranges, as well as on the ranges themselves. This additional location for testing is included only in the Preferred Alternative. In the other alternatives, use of the connecting waters would have to be analyzed as a separate action if and when such use is proposed.

1.4 ORGANIZATION OF THE EA

This EA is a comprehensive environmental analysis document that encompasses the following six sections:

Introduction — This section incorporates the authority and jurisdiction for this project, as well as the project history and its purpose and need.

Proposed Action and Alternatives — This section includes a description of the Proposed Action, description of the alternatives, and a summary of environmental impacts and mitigation.

Affected Environment, Environmental Consequences, and Mitigation — This section covers 13 issue areas, including a description of the affected environment, the environmental consequences of the alternatives, and proposed mitigation measures.

Cumulative Environmental Impacts — This section addresses the compounded impacts of other projects/actions in the area together with the Proposed Action, and evaluates the irreversible and irretrievable commitment of resources and the relationship between short-term use of the project site and long-term productivity.

References — This section includes literature references, records of communications (ROCs), correspondence, and internet references. Literature references in the document are indicated by the author's last name (or the agency) and the year of publication. Personal communications have been summarized in memo form as a record of communication and will be included in the Administrative Record to be retained by the Navy. In this EA, they are referenced in the text as ROC, followed by the last name of the person contacted and the date of communication. Internet references are recorded by their URL address.

List of Preparers and Distribution List – This section lists the staff and consultants responsible for preparing the document and the persons to whom the document was sent for review.

2.0 PROPOSED ACTION AND ALTERNATIVES

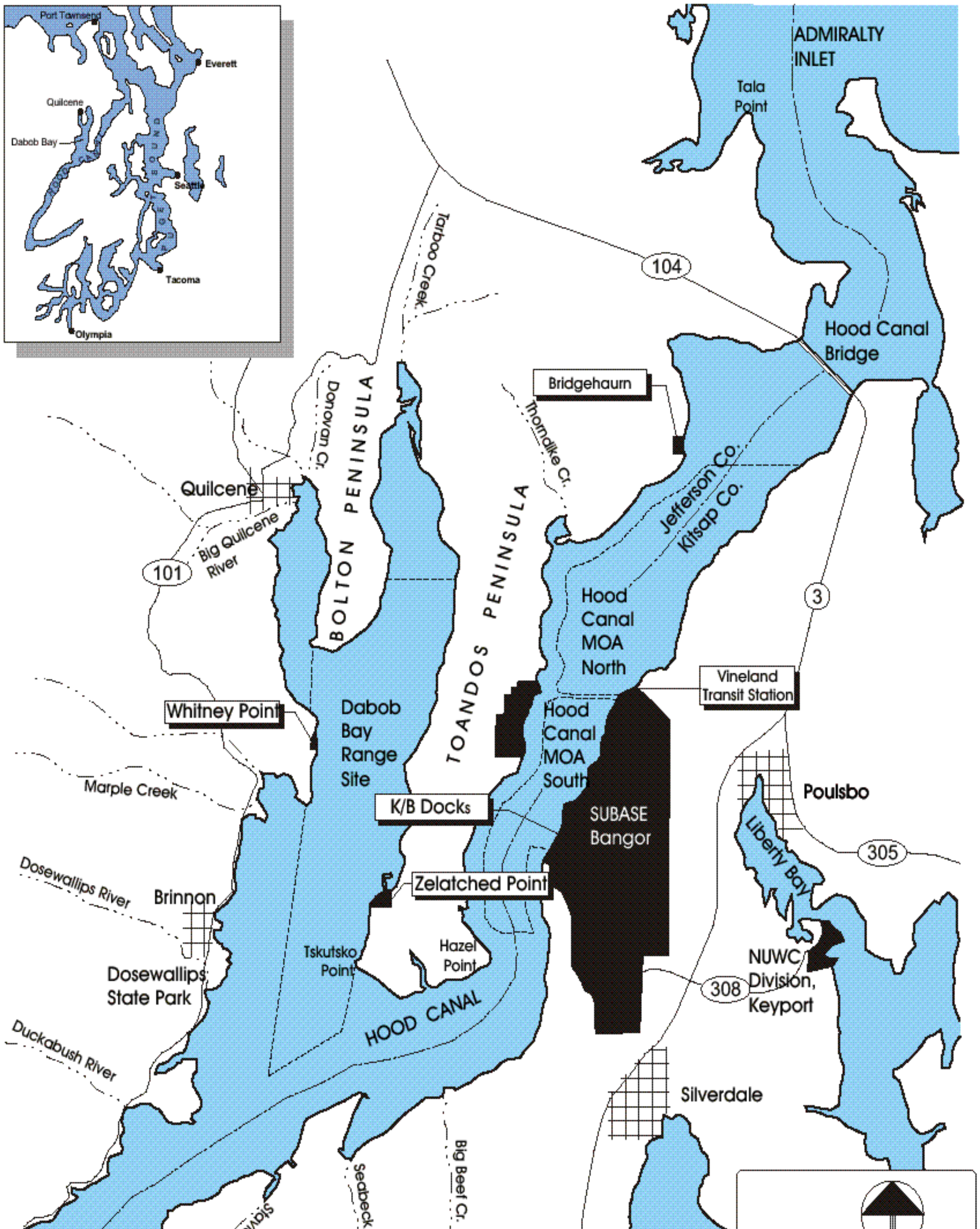
2.1 DESCRIPTION OF PROPOSED ACTION

The Proposed Action is the adoption and implementation of the OMP for the DBRC. The OMP comprehensively describes all in-water testing activity at the DBRC and identifies estimates of testing intensity levels for each type of test. The DBRC includes Dabob Bay, the two Hood Canal MOAs adjacent to SUBASE Bangor, and the connecting waters (Figure 2.1-1).

The Dabob Bay MOA is the principal range and only component of the DBRC with extensive acoustic monitoring instrumentation installed on the seafloor allowing for acoustic tracking of tests. The Navy has no plans for installing any permanent tracking systems within the connecting waters or within the Hood Canal MOAs. If acoustic monitoring is required for testing in these areas, as it occasionally is, temporary floats supporting acoustic devices are placed in the water for the duration of the test and then recovered afterward.

Testing operations typically occur only on Mondays through Fridays during daylight hours. The majority of testing occurs at the Dabob Bay MOA, which is about one hour by boat from the Keyport/Bangor (K/B) docks at SUBASE, the main shore-based staging area. Some launch and recovery testing (consisting mostly of short duration tests) occurs in the Hood Canal MOAs, which are within 10 minutes travel distance from K/B docks. None of these tests involve explosive warheads, and explosive warheads are never placed on test units. The Navy plans to begin more extensive testing on a regular basis of UUVs, which would involve transiting between the MOAs as established in Dabob Bay and Hood Canal. No new shore facilities are proposed in the OMP.

The in-water testing programs can be divided into 4 types: research and experimental (R&E) (65 percent of all testing); proofing (15 percent of testing); fleet operations (15 percent of testing); and other operations (5 percent of testing). R&E testing involves evaluating the operational capabilities of experimental test units, including torpedoes, UUVs, targets, and countermeasure systems. Proofing involves production acceptance tests in support of the torpedo procurement process to ensure units meet all performance specifications. Fleet operations tests assess the combat readiness of a vessel, system, and/or personnel, and involve aircraft, surface ships, and submarines. Other operations testing includes unique, non-repeated functions that are similar in scope and function to the standard range operations, as well as tests in support of other federal agencies, such as the National Oceanic and Atmospheric Administration (NOAA), principally acoustic tests of their ships and research equipment.



Source: NOAA, US NAVY

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Military Facilities in Vicinity of Dabob Bay/Hood Canal MOAs

Figure 2.1-1

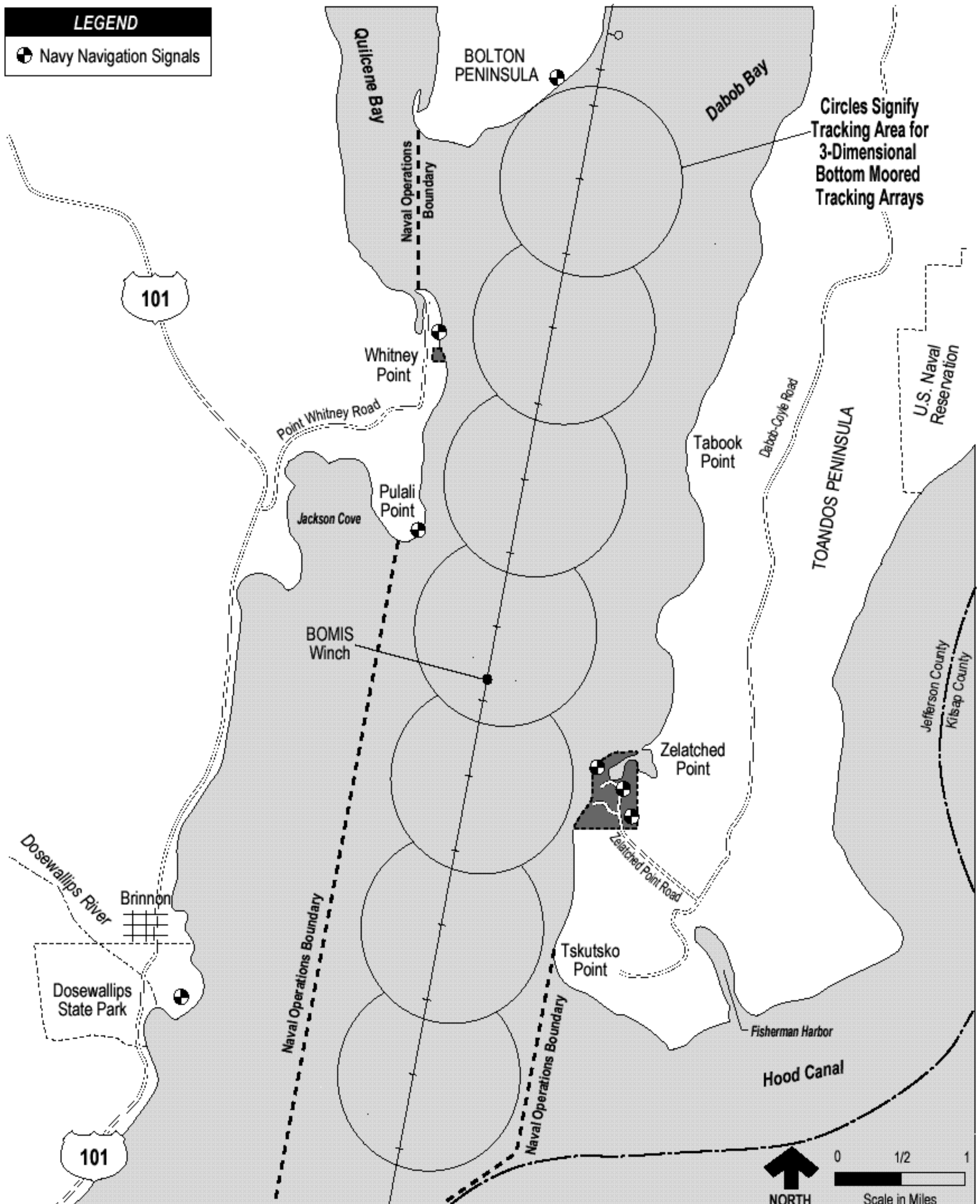
The intensity and frequency of operations and types of tests vary widely depending on the underwater systems testing programs. In general, operations in the two Hood Canal MOAs are limited to simple testing, typically involving brief launch and retrieval operations lasting 15 to 20 minutes. The test unit is typically in sight throughout the test. These relatively simple tests are best done in the Hood Canal MOAs because no sophisticated acoustical tracking devices are required, and transit time for surface craft involved is limited to 10-15 minutes, rather than the hour or more travel time to Dabob Bay. This approach minimizes the cost and environmental impacts of testing. Dabob Bay is used for more complicated testing that requires any and all of the following: extensive acoustic monitoring, use of the helipad at Zelatched Point, very low levels of ambient background noise in the water, and/or need for greater control of the general testing environment.

Further information about the operations and types of testing, is provided in Section 2.3 - Actions Included in the Operations and Management Plan (Appendix A). The physical characteristics of the different ranges and related facilities are described below.

2.1.1 Dabob Bay Military Operating Area

The Dabob Bay MOA is bounded on the northwest by Bolton Peninsula, on the west by Quilcene Bay, on the east by Toandos Peninsula, and on the south by the Hood Canal (see Figure 2.1-2). Within the waters of Dabob Bay, the MOA is approximately 8.5 nm long, and varies between 1.3 and 2.5 nm in width (12 by 1.8-3.5 km). The Dabob Bay MOA encompasses all waters of Dabob Bay, except for the navigable waters along the western shoreline. In Dabob Bay the MOA is defined as all waters beginning at latitude 47 deg. 39’27”, longitude 122 deg. 52’22”; thence northeasterly to latitude 47 deg. 40’19” longitude 122 deg. 50’10” thence northeasterly to a point on the mean high water line at Takutsko Point; thence northerly along the mean high water line to latitude 47 deg. 48’00”; thence west on latitude 47 deg. 48’00” to the mean high water line on the Bolton Peninsula; thence southwesterly along the mean high water line of the Bolton Peninsula to a point on longitude 122 deg. 51’06”; thence south on longitude 122 deg. 51”06” to the mean high water line at Whitney Point; thence along the mean water line to a point on longitude 122 deg. 51’15”; thence southwesterly to the point of beginning (33 CFR 33.1190).

The western MOA boundary in Dabob Bay is about 1 mile (1.6 km) east of the high water mark at Sylopash Point in Dosewallips State Park, follows the shoreline between Pulali Point and Whitney Point, and crosses the mouth of Quilcene Bay on the Olympic Peninsula. Geographically, the center of the range is located at 47º 43’ 34” North, 122º 50’ 28” West. Average depth at the site is 375 feet (114 m) with a maximum depth of 600 feet (183 m). Site operations are controlled and recorded at the Range Control Center located at Zelatched Point on the Toandos Peninsula.



Sources: NOAA 1989; Jennings et al. 1996

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Dabob Bay MOA

Figure 2.1-2

In addition to the actual water-based range, the Dabob Bay MOA includes several land-based facilities. The Zelatched Point area occupies 28 acres (11.2 ha) of land overlooking Dabob Bay that is owned by the Navy. An additional 21.8 acres (8.8 ha) of second-class tideland abutting the upland parcel was acquired by a Specific Use Deed from the state (see Figure 2.1-3). Major site facilities include a 2,500 square foot (SF) (232 m^2) computer building and a 150-foot (46 m) radio tower located on a bluff 200 feet (61 m) above mean sea level (msl). Beach facilities include a Navy pier with float, a boat ramp, a helipad, a surface radar tower, warning beacons, and a winch house. A portion of the property includes an estuarine wetland southeast of the pier. The wetland is fed by an unnamed, intermittent stream that runs north across the Navy property.

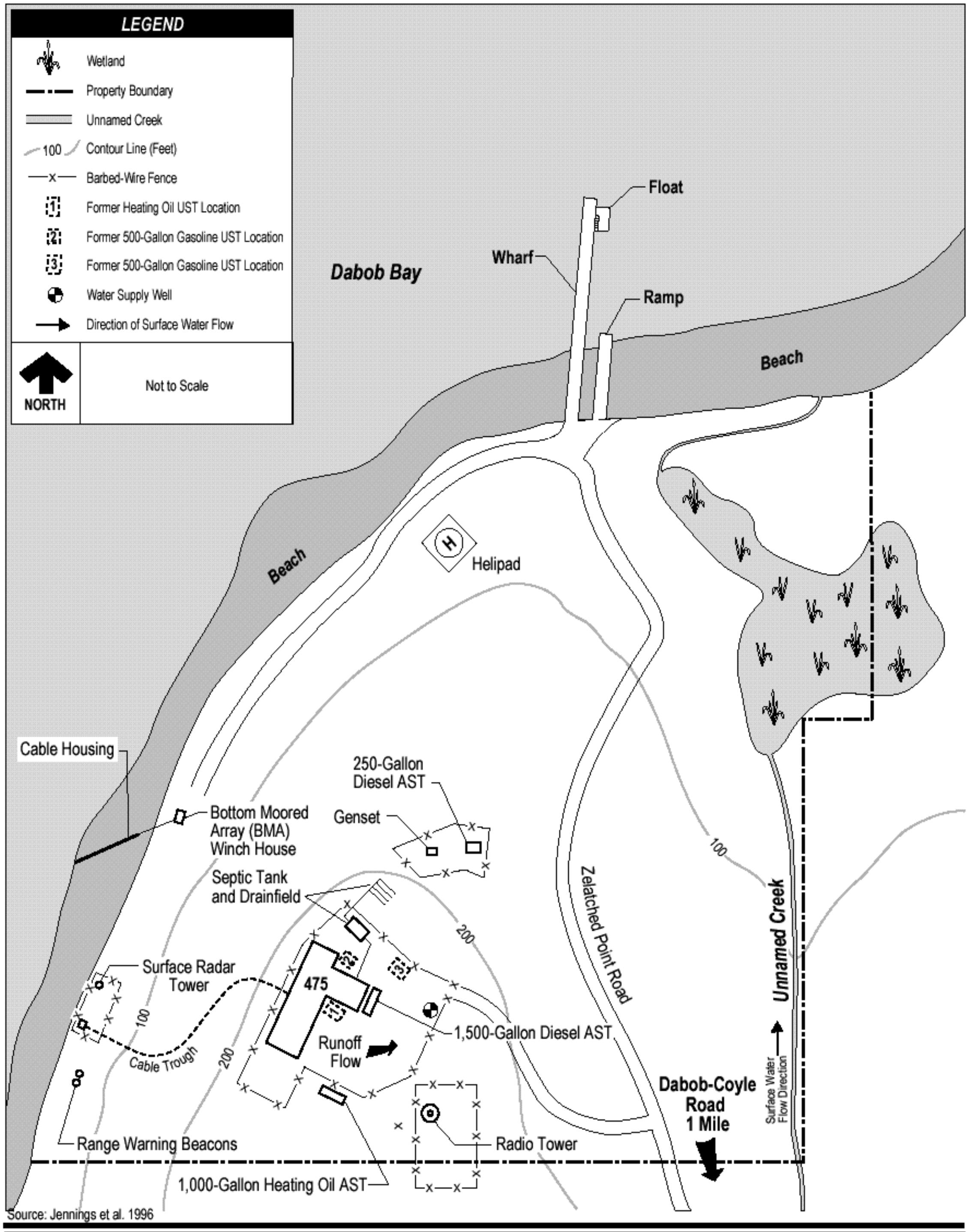
The pier at Zelatched Point has been historically used for float planes and range craft berthing during operations. It is 300 feet (91 m) in length and can accommodate range craft. There is no power supply or pump-out capability at the Zelatched pier, limiting the capability of the pier to temporary mooring purposes only. Typical range craft used during operations, which can be expected to tie up at the pier, are summarized in Table 2.1-1. Mobile cranes are occasionally brought out to the site to handle equipment. There is a helicopter pad near the base of the pier, which is used occasionally by aircraft involved in launching and recovery of test units.

Motorized barges and miscellaneous small boats are also used for operations. Seven permanently deployed tracking arrays are used to acquire and record underwater noise with a frequency of 75 kHz and provide three-dimensional tracking information. They are spaced approximately 2,000 yards (1,829 m) center to center along a datum line that is oriented north/south through the center of Dabob Bay (see Figure 2.1-2). A single Bottom Moored Array (BMA), along with other noise-monitoring devices, provides a full spectrum capability for the measurement and analysis of radiated noise, structure borne noise, and ambient noise in support of range operations. The BMA can be vertically positioned to any depth between 100 and 425 feet (30 and 130 m) below the surface, using an adjustable cable. Cabling and sensitive equipment moored on the bottom of Dabob Bay within the MOA are used to measure acoustic/magnetic signals or act as communications and warning systems.

Table 2.1-1: Dimensions and Use of Typical Range Craft.

Type of Craft	Weight	Length/Beam/Draft	Use
Yard Torpedo Tender (YTT)	1,200 tons (1,089 mt)	186’/40’/10’6”	Launching/recovery of underwater ordnance and range maintenance support.
Torpedo Retrieval Boat (TRB)	41.2 tons (37.4 mt)	72.9/17’/6’6”	Torpedo and mobile target retrieval and personnel transport.
Yard Patrol (YP)	176 tons (160 mt)	108’/24’/6’	Sound/target boat and personnel transport.
Work Boats	6,000 lbs (2,727 kg) max	24’/8’/34” max	Range maintenance and special projects support.

Source: NUWC Division Keyport 1999



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Zelatched Point Site Map

Figure 2.1-3

Navy-maintained yellow, white, and red warning lights are located at Sylopash Point, Pulali Point, Whitney Point, Zelatched Point, and the southeast edge of Bolton Peninsula, all within sight of the Dabob Bay MOA. The purpose of the lights is to warn non-military craft of the status of operations in the MOA. The descriptions of the lights are posted at local boat ramps and marinas in the area on NUWC Keyport Form 5720/3 (Rev 6-93) (see Figure 2.1-4). Marine radio channels 12 or 16 are also monitored during operations (call sign = DABOB CONTROL). Naval Guard Boats may also be used to require non-military craft in the MOA to stop engines for the duration of operations. The purpose of halting marine traffic is to eliminate acoustic interference during noise-sensitive testing. Halting marine traffic is not required as a safety measure, as test units run at sufficient depth and have no live warheads such that surface vessels are not at risk. Navy jurisdiction is detailed in 33 CFR § 334.1190.

Yellow or alternating white and yellow lights indicate to non-military craft that:

- They should proceed with caution;
- Range operations are in progress, but no acoustic measurement tests are in progress; and
- Be prepared to shut down engines when lights change to red.

Red or alternating white and red lights indicate:

- Range operations are in progress with critical measurements in progress;
- Stop engines until red beacons have been shut off, showing test is completed; and
- Follow advice of Naval Guard Boats when in or near the range area.

These instructions are clearly indicated on standard NOAA charts. Typically, boat passage is permitted between tests when the yellow beacons are operating. Usual hours of operation for the range are during daylight hours on weekdays. Normally, tests and torpedo runs are confined to periods of less than 60 minutes. Submarine operations can occur for longer periods, approximately 8 to 16 hours.

2.1.2 The Hood Canal Military Operating Areas

The two Hood Canal MOAs are located 6 miles (10 km) west of Keyport, immediately offshore from SUBASE Bangor. Range dimensions are approximately 4.2 by 1 nm (75 by 1.9 km), and the range center is located at 47º 46 00 North, 122º 44 00 West. The Hood Canal MOA includes those waters between latitude 47 deg. 46’00” and latitude 47 deg. 42’00”, exclusive of navigation lanes 0.25 nm (0.46 km) wide along the west shore and along the east shore south from the town of Bangor (latitude 47 deg. 43’28”) (33 CFR § 334.1190).

ATTENTION BOAT OPERATORS IN – DABOB BAY –

DUE TO TESTING OF TORPEDOES AND OTHER UNDERWATER WEAPONS IN DABOB BAY BY THE U.S. NAVY, THE FOLLOWING RESTRICTIONS APPLY TO ALL BOAT OPERATORS WHEN IN THE RANGE OPERATING AREA SHOWN IN THE FIGURE BELOW. **DUE TO DEPLOYED SYSTEMS USED ON RANGE, CRAFT SHOULD STAND WELL CLEAR (1000 YDS) OF RANGE VESSELS AT ALL TIMES.**

– RANGE WARNING LIGHTS –

- SYLOPASH POINT
- PULALI POINT
- BOLTON PENINSULA (SE)
- ZELATCHED POINT
- WHITNEY POINT

FLASHING AMBER

OPERATIONS ARE IN PROGRESS BUT NO WEAPONS OR SOUND TESTS BEING CONDUCTED. PROCEED WITH CAUTION AND CHECK FREQUENTLY FOR LIGHTS TO CHANGE TO FLASHING RED.

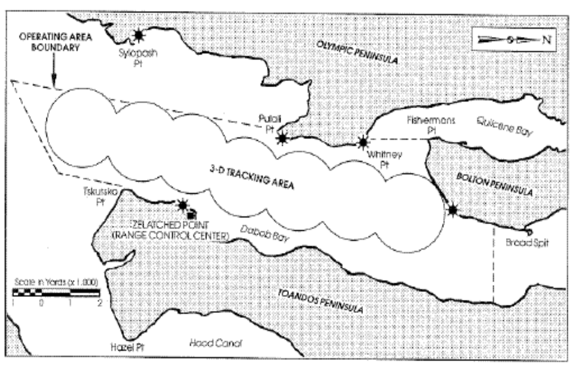
FLASHING RED

– WEAPON ABOUT TO BE FIRED.
– SUBMARINE IS SUBMERGED.
– MINIMUM NOISE TESTS IN PROGRESS.
– GENERALLY HAZARDOUS TO BOATERS.

ACTION

1. IF IN AREA WHEN **FLASHING RED LIGHTS** APPEAR:
   A. STOP PROPELLERS, MOTORS, AND OTHER EQUIPMENT GENERATING UNDERWATER NOISE. (SOME TORPEDOES ARE GUIDED BY NOISE, THEREFORE THEY COULD BE ATTRACTED TO YOUR BOAT NOISES.)
   B. IF YOUR LOCATION IS HAZARDOUS, YOU WILL BE SO ADVISED BY NAVAL GUARD BOAT PERSONNEL. **FOLLOW THEIR ADVICE!**
2. IF **NOT** IN RESTRICTED AREA WHEN **FLASHING RED LIGHTS APPEAR:**
   A. *DO NOT ENTER!*
   B. WATCH FOR **FLASHING AMBER LIGHTS** TO REAPPEAR BEFORE PROCEEDING. TESTS/FIRINGS WILL **NORMALLY** BE CONFINED TO INTERMITTENT PERIODS OF LESS THAN 30 MINUTES DURATION, WITH BOAT PASSAGE PERMITTED BETWEEN TESTS (I.E. WITH FLASHING AMBER LIGHTS).
3. THE RANGE CONTROL CENTER AT ZELATCHED POINT CAN BE CONTACTED ON MARINE CHANNEL 16.

WARNING LIGHT LOCATIONS



WARNING

THE CONTINUAL VIOLATION OF THE ABOVE OPERATION RESTRICTIONS COULD RESULT IN PERSONNEL INJURY AND PROPERTY DAMAGE OR ACTION BEING BROUGHT AGAINST BOAT OPERATORS!!

NAVAL UNDERSEA WARFARE CENTER DIVISION
KEYPORT WA 98345–7610

Source: NUWC KeyPort 5720/3, 1993

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Example of Typical Notice to Mariners

Figure 2.1-4

The range is divided into the Hood Canal MOA North and Hood Canal MOA South. The Hood Canal MOA North runs approximately from Bridgehaven (47º 50’ 00 North) on the Toandos Peninsula across to the eastern shore of the canal, south to an area approximately level with the Vinland Transit Station (46º 00’ 00 North). The Hood Canal MOA South runs from the southern end of MOA North, farther south to an area just north of Hazel Point (42º 00’ 00 North). The water depth averages 200 feet (61 m).

The Hood Canal MOAs are used to conduct tests that determine vessel sensor accuracy, special torpedo launches/recoveries, and for simple tests not requiring tracking. Torpedo testing in the Hood Canal MOAs are to test the launch, start-up, and recovery capability only, not for full torpedo operations as are conducted in the Dabob Bay MOA. Electric units (rather than thermal units) are typically tested, with most test runs between 30 seconds to 1 minute in duration. There are no permanent facilities or tracking equipment in place in this range, or are any planned. Portable range equipment for tests may be temporarily deployed in the range for acoustic tracking, when required.

2.1.3 Connecting Waters

The connecting waters refer to that portion of the Hood Canal that connects the Dabob Bay MOA with the Hood Canal MOAs, along the southern edge of the Toandos Peninsula. No permanent Navy equipment is present in this area. The area is currently used only for transiting vessels within the DBRC. In the future, it could be used as a transit area for UUV test runs that start in the Hood Canal MOAs and end in Dabob Bay MOA, or vice-versa. Water depth in the connecting waters area is typically greater than 300 feet (91 m). The shortest distance between the Dabob Bay MOA and the Hood Canal MOA by water is approximately 3.75 nm (6.9 km).

2.1.4 Other Navy Support Facilities Involved

Multiple other Navy facilities outside of the range area are involved in supporting the testing activities at the DBRC. Most of the range craft are berthed at the K/B pier, located on the south end of the SUBASE Bangor waterfront along the east shore of Hood Canal. This is the starting point for a typical test, with the test unit being off-loaded from trucks onto the vessel from which it will be launched. The test unit will then typically be returned to the K/B dock at the end of its test run. A test may also start or end at NUWC Division Keyport, being on-loaded or off-loaded from a test vessel at the Keyport pier. Occasionally tests involve Navy aircraft. In this case the test unit will typically be transported to Naval Air Station, Whidbey Island (NASWI) by flatbed truck and loaded onto aircraft, which then fly to the DBRC and launch these test units. At infrequent intervals, test units may be transported over the road to or from Zelatched Point and then loaded onto test vessels or helicopters.

Fueling service occurs at locations away from the ranging facilities. Boat holding tanks are pumped out at the K/B Pier into an approved sewage system.

2.2 DESCRIPTION OF ALTERNATIVES

This EA analyzes three alternatives (the Preferred Alternative, a Dabob Bay Limited Alternative, and the No Action Alternative), as described below.

The Preferred Alternative would allow testing at all of the areas identified in Section 2.1 and provides for a comprehensive, consolidated, and overarching environmental policy for testing using the OMP. The Dabob Bay Limited Alternative would confine testing to the Dabob Bay MOA only, and would not include the Hood Canal MOAs or the connecting waters. The Dabob Bay Limited Alternative would consolidate the testing into a smaller geographic area, while incorporating an overarching environmental policy and the use of the OMP. The No Action Alternative is defined as not adopting the OMP. Thus, the No Action Alternative essentially preserves the status quo, which would allow for continued testing of a variety of programs as they evolve with individual environmental reviews, but without the overarching comprehensive OMP.

The two action alternatives would allow users of the DBRC who follow the procedures of the OMP to use this Environmental Assessment for their specific program NEPA document. Under the No Action Alternative, the individual program directors would continue to be responsible for documenting the environmental effects of their specific program.

2.2.1 Preferred Alternative – DBRC

The Preferred Alternative consists of the adoption of the OMP with the full range of options for operations and testing intact. This includes the ability to utilize the entire DBRC for the full spectrum of operations identified for those areas in the OMP. The DBRC includes Dabob Bay, the two Hood Canal MOAs adjacent to SUBASE Bangor, and the connecting waters (Figure 2.1-1). The Dabob Bay MOA is the principal range and only one with extensive acoustic monitoring instrumentation installed on the seafloor allowing for acoustic tracking of tests. The Navy does not anticipate installing any permanent tracking systems within the connecting waters or within the Hood Canal MOAs. Any tests in these areas requiring acoustic tracking would place temporary monitoring devices in the water suspended from floats and recover them after the test. The majority of testing occurs at Dabob Bay, which is about one hour by boat from the K/B docks at SUBASE, the main shore-based staging area. Some launch and recovery testing (consisting mostly of short duration tests) occurs in the Hood Canal MOAs, which are within 10 minutes travel distance from K/B docks. Explosive warheads are never placed on test units. The Navy plans to begin more extensive testing on a regular basis of UUVs, which would involve transiting the MOAs as established in Dabob Bay and Hood Canal and the connecting waters. No new shore facilities are proposed in the OMP.

2.2.2 Alternative 2 - Dabob Bay Limited Alternative

The Dabob Bay Limited Alternative would limit operations implementing the OMP to the Dabob Bay MOA. Acceptance of this alternative would preclude use of the Hood Canal MOAs or the connecting waters for operations addressed by the OMP. All other operations identified for the Preferred Alternative would be included in this alternative, but they would be confined to the Dabob Bay MOA.

2.2.3 No Action Alternative

The No Action Alternative provides that there would be no implementation of the OMP. Under this alternative, military testing and evaluation operations within the Dabob Bay MOA and the two Hood Canal MOAs would continue to be carried out as it has in the past. Operations would be guided by the current Range Operating Procedures (ROP), NUWC Report #1509 and applicable Navy regulations and guidance. In this case, individual programs would be required to conduct independent environmental assessments of their particular program prior to conducting their operations (i.e., maintaining the status quo). NEPA compliance would therefore be conducted on a program-by-program basis, rather than for the range as a whole. This would lead to more associated costs and less overall consistency in the approach to NEPA compliance. Testing parameters such as number and type of operations would be defined by the individual programs within their NEPA documentation. While the ROP provides management and operations guidelines on an individual basis, there would be no summary document defining what can and cannot occur at the DBRC under NEPA. Environmental compliance procedures would continue to be guided by NEPA, Navy OPNAVINST 5090.1B, and other appropriate policy and guidance.

2.3 ACTIONS INCLUDED IN THE OPERATIONS AND MANAGEMENT PLAN

The Operations and Management Plan describes the underwater vehicles systems test activities within the geographic boundaries of the DBRC. It focuses on managing the operations at the DBRC within current mission requirements. The OMP summarizes the various test characteristics including categories of operation and activities, the Navy's test range management program, and environmental issues associated with operations. The adoption of the OMP is intended to ensure comprehensive and coordinated planning policies are defined for the DBRC and to allow the continued operation of the test ranges, while maximizing the existing and future potential use of the DBRC resources by NUWC Division Keyport. "The OMP is not intended to preclude the changing of current process to ones which are more environmentally friendly as they are identified." The mitigation measures identified in this EA will be incorporated into the OMP.

2.3.1 Testing Categories

Operations conducted on the range sites can be divided into four categories: research and experimental, proofing, fleet operations, and other operations. All vessels operating in the DBRC do so under applicable Coast Guard navigation regulations (per 33 CFR). The following is a brief synopsis of the estimated level of activity associated with each of these categories within the DBRC for future operations. The estimated number of launches totals approximately 285 launches per year. (A "launch" includes underwater vehicle system test runs, as well as any vessel test runs.)

- Research and Experimental: Approximately 65 percent of annual testing is research and experimental in nature to evaluate the operational capabilities of test units. Primary systems involved with experimental tests include torpedoes, targets, UUVs, and stationary measurement platforms.
- Proofing: Approximately 15 percent of annual testing involves proofing or production acceptance testing, which ensures that the torpedo meets all service performance standards including quality, reliability, maintainability, and supportability. MK 48 torpedoes are the primary underwater vehicle systems involved in proofing tests.
- Fleet Operations: Approximately 15 percent of annual testing encompasses fleet operations, which involve evaluation programs and equipment tests for the Navy. Evaluation programs are utilized to assess the combat readiness of a vessel, system, and/or personnel. Tests in this category conducted at the MOA include submarine testing and surface ship testing. This testing is accomplished to certify that the vessels are ready for their operational missions.
- Other Testing Activities: Approximately 5 percent of annual testing is comprised of other tests, including range work and other miscellaneous testing efforts within the DBRC. Some of the testing is accomplished in support of the National Oceanic and Atmospheric Administration (NOAA) and other organizations.

Most of these operations require support operations prior to and upon completion of the test. Support operations include measuring the environmental conditions prior to testing and the retrieval/recovery of the test unit upon completion.

Table 2.3-1 shows the number of days the DBRC was used from 1997 through 1999, an average of 134 days per year. Historically, national security requirements have caused the number of days the range is used to vary significantly.

Table 2.3-1: Dabob Bay Range Complex Usage 1997-1999.

	Number of Days											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1999	9	20	16	8	3	4	8	9	16	17	4	7
1998	11	10	17	17	10	13	14	15	16	8	6	7
1997	12	9	12	6	11	11	15	13	13	14	9	13
Average	10.7	13	15	10.3	8	9.3	12.3	12.3	15	13	6.3	9

Source: U.S. Department of the Navy, 2000.

2.3.2 Underwater Vehicle Testing Steps

Torpedoes tested in the DBRC fall into 2 categories: heavyweight and lightweight. Neither of these categories includes torpedoes with explosive warheads. Heavyweight torpedoes are defined as weighing at least 2,000 lbs (907 kg). Lightweight torpedoes are defined as weighing up to 800 lbs (364 kg). A typical test involving a torpedo operation would follow a series of steps prior to, during, and after the test. These same steps are used during the testing of mobile targets and UUV's. These typical steps are described below.

1. Prior to testing, the underwater vehicle would be prepared in shop and loaded onto a truck for transportation to the staging site (SUBASE Bangor, NASWI, etc.).
2. At the range, the underwater vehicle is off-loaded from the truck and loaded onto the firing craft (air, surface, or submarine). Sixty-five percent of all launches take place from the Yard Torpedo Tender (YTT) firing craft.
3. On range day, the underwater vehicle would be prepared for firing and launched from the firing craft toward a Navy target.
4. During the course of the test, the underwater vehicle transmits coded acoustic signals that are received by a series of underwater sonar arrays set on the floor of Dabob Bay. The tracking signals are transmitted to the range site tracking center at Zelatched Point for decoding and interpretation.
5. After the completion of the test, the spent underwater vehicle either floats to the surface or sinks to the bottom of the bay. The test unit is retrieved by surface craft or helicopter, or recovered by underwater devices and vehicles.
6. Upon recovery or retrieval of the underwater vehicle , it is off-loaded from the recovery craft, trucked back to the shop, unloaded, and prepared for next operation.

Many of the tests use acoustic signals for tracking and monitoring. These signals are emitted by test units as they travel, are monitored by a variety of underwater tracking arrays placed on the floor of Dabob Bay, and transmitted to shore-based facilities through cables, as described in Section 2.2. All of the underwater test units transmit a focused acoustic signal at 75 kHz at regular intervals. Certain test units also transmit energy in the 0.05-350 kHz band. Certain tests involving test targets emit a noise that simulates the reflection of an active sonar pulse off of a submarine, with a frequency up to 100 kHz. Countermeasure devices are also tested that emit noises intended to distract torpedoes from their target. The emitted noise ranges from a broadband mechanically generated noise to an electronically generated sweep over specific frequencies up to 85 kHz.

2.3.3 Testing Activity Summary

The activities involved in accomplishing the above-mentioned range operations are summarized in Tables 2.3-2 through 2.3-4. These tables identify the types of testing events by category and establish an estimated amount for each test as analyzed in the EA. The activities identified in Tables 2.3-2 through 2.3-5 are organized by the categories of Launching Systems, Types of Systems Tested, Test Propulsion Systems, and Systems Retrieval and Recovery, as described below. Multiple activities can be conducted during each test. Therefore, Tables 2.3-2 through 2.3-5 should not be read to indicate that the DBRC is constantly in active use. In fact, during 1997 the Dabob Bay MOA conducted testing on 138 days and the Hood Canal MOAs tested on approximately 60 days. These tests are often conducted concurrently. The projected ceiling on the annual range usage as identified in Tables 2.3-2 through 2.3-5 was used as the basis for impact analysis in this EA, as discussed in Chapter 3. These levels reflect a potential operational tempo that could occur, although actual use is expected to be somewhat less, similar to usage in recent years. In general, when any one test increases substantially, other test levels tend to decrease. Consequently, this document evaluates the highest probable level of impact and provides a level of analysis that is conservative in its protection of the environment. This EA addresses current weapons technology at use in the ranges. As technological advances are made that allow for more environmentally friendly underwater weapons or vehicles, the Navy will consider adopting these systems to minimize environmental impacts.

2.3.3.1 Launching Systems

Launching systems are the various range support vessels, fleet vessels, or aircraft from which test units are launched (see Table 2.3-2). The majority of launches occur from range support vessels such as the YTT and special purpose barges.

2.3.3.2 Types of Systems Tested

The weapons propulsion systems tested include thermal propulsion systems, such as the Otto Fuel II system and the Stored Chemical Energy Propulsion System (SCEPS). In addition, electric systems used during the testing include

Table 2.3-2: Launching Systems Used at the DBRC.

Activity	Platform/Systems Used	Estimated Annual Range Usage
Launching Systems	Range Support Vessels • YTT firing craft • Special purpose barges	 Up to 180 launches Up to 75 launches
	Fleet Vessels	Up to 20 launches
	Aircraft	Up to 10 launches

Source: Department of the Navy 1999b

2.3.3.3 Types of Systems Tested

The weapons propulsion systems tested include thermal propulsion systems, such as the Otto Fuel II system and the Stored Chemical Energy Propulsion System (SCEPS). In addition, electric systems used during the testing include the electric vehicles used at the ranges, such as the General Test Vehicles (GTVs), UUVs, and targets. Other testing activities include submarine testing, mine sweeping, trawler exercises, acoustic and magnetic array testing, countermeasures, impact testing, and static testing in water. Table 2.3-3 summarizes the test units used at the DBRC, as well as a projected ceiling of range usage for each. Table 2.3-4 summarizes the related propulsion system.

Table 2.3-3: Types of Underwater Vehicles Systems Tested.

Activity	Platform/Systems Used	OMP Estimated Annual Range Usage[1]
Thermal Propulsion Systems	Otto Fuel II	Approximately 90 test
	Stored Chemical Energy Propulsion System (SCEPS) • MK 50 • Torpedo Defense Vehicle (TDV)	 Approximately 10 tests Approximately 10 tests
	Experimental Thermal Systems	Approximately 20 tests
Electric Systems	General Test Vehicles (GTV)	Approximately 60 tests
	Unmanned Underwater Vehicles (UUV)	Approximately 60 tests
	MK 30 Target	Approximately 20 tests
Other Testing Activities	Submarine Testing	Approximately 45 tests
	Mine Sweeping	Approximately 20 tests
	Non-Navy Testing (such as trawler exercises)	Approximately 5 tests
	Acoustic and Magnetic Array Testing	Approximately 10 tests
	Countermeasures	Approximately 50 tests
	Impact Testing	Approximately 10 impacts
	Static Testing in Water	Approximately 10 tests
Fleet Operations	Surface Ship Operations (excluding launches)	Approximately 10 tests
	Aircraft Operations	Approximately 10 tests
	Submarine Operations	Approximately 30 tests

[1] *There may be multiple tests per launch*

Source: Department of the Navy 1999b

Thermal Propulsion Systems

There are three types of thermal propulsion systems tested at DBRC: Otto Fuel II, SCEPS, and experimental thermal systems.

Otto Fuel II: Otto Fuel II propulsion systems power the majority of torpedoes tested at the Dabob Bay ranges. These propulsion systems are based on an external combustion engine that employs a monopropellant. Heat is transferred from the engine to the cooling water, which is then mixed with exhaust gases from the engine cylinders and discharged into the seawater via the hollow propeller drive shaft.

Table 2.3-4: Test Propulsion Systems.

Test Unit	Propulsion System
Heavy Weight Torpedoes	Otto Fuel II
Light Weight Torpedoes	Otto Fuel II SCEPS
Experimental Thermal Systems/Exotics	Possible variation of SCEPS, rocket fuels, JP-5, or other fuels. Others unknown at this time.
General Test Vehicle	Silver/nickel battery electric engine
Unmanned Underwater Vehicle	Silver/nickel battery electric engine
MK 30 Mobile Target	Silver/nickel battery electric engine
Submarine Testing	Nuclear propulsion systems
Mine Sweeping	Gas turbine engines
Non-Navy Testing	Gas turbine or diesel
Acoustic and Magnetic Array Testing	N/A
Counter Measures	N/A
Impact Testing	Otto Fuel II SCEPS
Static Testing	Otto Fuel II

Source: Department of the Navy 1999b.

Stored Chemical Energy Propulsion System (SCEPS): SCEPS is a closed cycle, Rankine steam system. The major components of the system are the boiler (with steam generating tubes), turbine, condenser, and condensate pump. In the boiler, sufficient heat is absorbed to change the state of the water from liquid to steam. The high pressure steam is used to rotate a small turbine, connected via reduction gears to the drive shaft. Both the reactants and products of the reaction are contained within the internal reaction chamber of the boiler and only heat escapes into the environment. The reactant, SF6, a component of the SCEPS system, is being phased out due to concerns under the Kyoto Protocols regarding the reduction of global warming gasses. The condensation and steam are sealed within their own separate system and do not contact the reactants or products of the reaction. Heat is transferred from the steam to the cool seawater passing over the torpedo via the condenser incorporated into the torpedo outer shell.

Experimental Thermal Systems: These experimental systems use both open and closed systems; some will have byproducts and/or acoustics while some will not. The precise components of these systems are under development and are undetermined at this time. An estimated 20 runs per year would be conducted on the DBRC. Possible fuel systems include JP-5, variations of SCEPS fuel, and rocket fuel.

Electric Systems

A number of different test units are powered by electric motor using silver-zinc batteries, including unmanned underwater vehicles (UUV), general test vehicles (GTVs), and MK-30 targets. The MK-30s are mobile targets used in Fleet training. The UUVs and GTVs are unmanned submersibles which can undertake a number of testing missions.

Other Testing Activities

This is an obviously broad category of tests which includes most activities other than testing torpedoes, generally using the acoustic profiling capabilities of Dabob Bay. Submarines are tested for various operational characteristics, and some mine sweeping tests are run. Non-Navy tests of tracking instrumentation, particularly from NOAA, are sometimes run. A few operations involving the installation of acoustic and magnetic equipment for calibration and/or testing are run each year.

A number of tests involving electronic counter measures are run each year. These are typically devices which distract a sonar, including a torpedo, from its target. At limited times countermeasures or simulated targets generating electromagnetic fields are tested in the Dabob Bay range. These tests consist of a ship or MK 30 torpedo towing a wire while traveling along the long axis of the range. The wire emits an electromagnetic field with an intensity of about $4\pi 10^{-6}$ Gausses/m, where m = perpendicular distance from the source in meters. The electromagnetic frequencies are less than 3,000 Hz. Testing can be near the surface or at depth, depending on the purpose of the test. Electromagnetic tests are conducted only about 10 times per year.

Impact tests are run fewer than 10 times a year. These involve a test where the torpedo is actually programmed to strike a target. A situation can then arise wherein the torpedo actually ruptures upon striking the target, with the potential to release pollutants in the form of fuel into the water column. While this potential is low, it nonetheless exists.

A small number of static tests are run in Dabob Bay each year, involving a torpedo attached to a stationary platform with its propeller removed. For those units powered by Otto II Fuel, exhaust gases are then released into a concentrated area rather than being distributed over the length of the run.

Fleet Operations

These are tests involving general fleet operations or NUWC Division Keyport operations. Fleet operations include surface ship operations such as frigates, cruisers, and destroyers; aircraft operations involving SH-60 MH-53, and P-3 aircraft (or equivalents); and submarine operations including SSN, SSBN, and SS submarines. Operations by Keyport at the DBRC in support of these tests typically encompass the support craft used to support test operations at the range and buoy use for vessel moorage; limited loading and storage facilities; operation of acoustic acquisition equipment used for measurement and recording of ambient noise, radiated self-noise, active noise, and sonar noise; operation of range tracking equipment such as underwater sonar and above water global positioning system (GPS); operation of targets, both mobile and stationary; and occasional use of privately contracted helicopters. A Towed Submarine Simulator (TOSS) trailed behind a vessel simulates the acoustic image of a submarine for test purposes and is used approximately 10 times per year.

2.3.3.3 Systems Retrieval and Recovery

Systems recovery and retrieval occurs after the completion of a test. Retrieval is the collection of the test vehicle from the surface of the water by vessel or helicopter. Recovery is the collection of the test vehicle when it is lying on the bottom of the bay or has become partially buried in the bottom sediments and requires some digging (see Table 2.3-5). Approximately 95 percent of the underwater vehicles tested contain buoyancy systems that allow the units to float on the surface of the water. Retrieval operations can be performed by surface craft, such as the TRB, or helicopters. Approximately 5 percent of the units sink to the bottom; these are retrieved using a Submerged Object Recovery Device (SORD) or a Remotely Operated Vehicle (ROV).

Table 2.3-5: System Retrieval and Recovery.

Activity	Platform/Systems Used	OMP Estimated Range Usage[1]
Buoyancy Systems	Positive Buoyancy	Approximately 155 test
	Active Buoyancy	Approximately 115 test
Negatively Buoyant Systems	Unburied Units	Approximately 15 test
	Buried Units	A minority of those units that go to the bottom bury themselves and have to be recovered.

Source: Department of the Navy 1999b

About 15 tests per year must be recovered from the bottom, some of these requiring minor excavation. Rarely (approximately 1 in every 5 years) a test vehicle has driven itself into the bottom sediments for its entire length, at the extreme, up to 28 feet (8.5 m) deep. Recovery of these vehicles requires excavating a hole that is approximately 30 feet (9.2 m) in diameter and 28 feet (8.5 m) deep or deeper.

2.4 EXCHANGE OF ACTIVE DATES FOR DABOB BAY/HOOD CANAL OPERATIONS AND OF ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES

The potential environmental effects and proposed mitigation measures are summarized in Table 2.4-1. The information presented in this table is based on the full analysis presented in Section 3.0.

The Navy recently commissioned the Battelle Marine Science Laboratory (MSL) to conduct a field study to document current water and sediment quality conditions at the DBRC test range in Dabob Bay, in preparation for this EA. The purpose was to augment existing scientific knowledge of the Dabob Bay marine environment, and to assess potential impacts to water and sediment quality from decades of ongoing Navy use of the test range. The results of the study (Crecelius 2001) are frequently cited in the document, and a copy of the study report is found in Appendix D. No evidence was found of degradation to water or sediment quality due to Navy actions.

2.5 FONSI OR EIS RECOMMENDATION

Based on the analysis presented in this EA, and in accordance with applicable regulations and statutes, the Navy has determined that implementation of the Proposed Action would not cause significant impacts to the environment; therefore, preparation of an Environmental Impact Statement (EIS) is not necessary, and a Finding of No Significant Impact (FONSI) is recommended.

Table 2.4-1: Comparison of Environmental Impacts and Mitigation Measures for the Preferred Alternative, Dabob Bay Limited Alternative, and the No Action Alternative.

Affected Environment	Preferred Alternative	Dabob Bay Limited Alternative	No Action Alternative
Water Quality and Hydrological Resources			
Environmental Impacts	• No significant impacts. • Small amounts of exhaust gas releases, as well as accidental fuel oil and very infrequent propellant spills from torpedo rupture. Oceanic mixing and dispersal would create non-toxic concentrations. • Temporary turbidity increases from occasional seabed retrievals. • Small amounts of lead from lost anchors, as well as copper from guide wires, could be released into water column. • A recent Battelle field study found heavy metals present only at low background levels.	• No significant impacts. • Similar to Preferred Alternative, with effects concentrated in Dabob Bay MOA. • A recent Battelle field study found heavy metals present only at low background levels.	• Similar to Preferred Alternative, with slightly reduced operation levels likely. • A recent Battelle field study found heavy metals present only at low background levels.
Mitigation Measures	• As no significant impacts are anticipated, no mitigation measures are proposed. • As technological advances are made allowing for more environmentally friendly weapons systems, the Navy will consider adopting these systems to further minimize impacts.	• As no significant impacts are anticipated, no mitigation measures are proposed. • As technological advances are made allowing for more environmentally friendly weapons systems, the Navy will consider adopting these systems to further minimize impacts.	• As no significant impacts are anticipated, no mitigation measures are proposed. • As technological advances are made allowing for more environmentally friendly weapons systems, the Navy will consider adopting these systems to further minimize impacts.

Table 2.4-1: Comparison of Environmental Impacts and Mitigation Measures for the Preferred Alternative, Dabob Bay Limited Alternative, and the No Action Alternative.

Affected Environment	Preferred Alternative	Dabob Bay Limited Alternative	No Action Alternative
Marine Sediments			
Environmental Impacts	• No significant impacts. • Temporary turbidity increases and localized disturbances from occasional seabed retrievals. • Small amounts of heavy metals could leach into sediments. • A recent Battelle field study found heavy metals present only at low background levels.	• No significant impacts. • Similar to Preferred Alternative, with effects concentrated in Dabob Bay MOA. • A recent Battelle field study found heavy metals present only at low background levels.	• Similar to Preferred Alternative, with slightly reduced operation levels likely. • A recent Battelle field study found heavy metals present only at low background levels.
Mitigation Measures	• As no significant impacts are anticipated, no mitigation measures are proposed. • As technological advances are made allowing for more environmentally friendly weapons systems, the Navy will consider adopting these systems to further minimize impacts.	• As no significant impacts are anticipated, no mitigation measures are proposed. • As technological advances are made allowing for more environmentally friendly weapons systems, the Navy will consider adopting these systems to further minimize impacts.	• As no significant impacts are anticipated, no mitigation measures are proposed. • As technological advances are made allowing for more environmentally friendly weapons systems, the Navy will consider adopting these systems to further minimize impacts.
Air Quality			
Environmental Impacts	• No significant impacts. • Minor air emissions related to ground transport and surface craft. • Rare occurrences of torpedo rupture would release SF6 oxidizer.	• No significant impacts. • Similar to Preferred Alternative, with effects concentrated in Dabob Bay MOA.	• Similar to Preferred Alternative, with slightly reduced operation levels likely.
Mitigation Measures	• As no significant impacts are anticipated, no mitigation measures are proposed.	• As no significant impacts are anticipated, no mitigation measures are proposed.	As no significant impacts are anticipated, no mitigation measures are proposed.

Table 2.4-1: Comparison of Environmental Impacts and Mitigation Measures for the Preferred Alternative, Dabob Bay Limited Alternative, and the No Action Alternative.

Affected Environment	Preferred Alternative	Dabob Bay Limited Alternative	No Action Alternative
Marine Flora and Fauna			
Environmental Impacts	• No direct impacts to subtidal or intertidal fish habitats, marine flora, invertebrates, or marine mammals. • Minimal impacts from exhaust gas releases, increased turbidity, and occasional minor bottom disturbance, as well as possible releases of pollutants and heavy metals (at levels not harmful) to marine flora and fauna.	• Similar to Preferred Alternative, with effects concentrated in Dabob Bay MOA.	• Similar to Preferred Alternative, with slightly reduced operation levels likely.
Mitigation Measures	• As no significant impacts are anticipated, no mitigation measures are proposed. • Navy will continue to conduct marine mammal surveys, with trained marine mammal oberservers, immediately prior to and during tests to avoid harassment and collision hazards, as required by the OMP.	• As no significant impacts are anticipated, no mitigation measures are proposed.	• As no significant impacts are anticipated, no mitigation measures are proposed.

Table 2.4-1: Comparison of Environmental Impacts and Mitigation Measures for the Preferred Alternative, Dabob Bay Limited Alternative, and the No Action Alternative.

Affected Environment	Preferred Alternative	Dabob Bay Limited Alternative	No Action Alternative
Terrestrial Flora and Fauna			
Environmental Impacts	• There is a potential for helicopter and fixed-wing aircraft flights to occasionally disturb the heron rookery or osprey nesting in project vicinity.	• Same as Preferred Alternative. • Increased insignificant effects to transient species using near shore environment in Dabob Bay MOA area.	• Similar to Preferred Alternative, with slightly reduced operation levels likely.
Mitigation Measures	• Helicopter and fixed-wing aircraft elevations are being standardized by the OMP to avoid disturbance to nesting heron rookeries and nesting osprey .	• Same as Preferred Alternative.	• Same as Preferred Alternative.
Threatened and Endangered Species			
Environmental Impacts	• No significant effects anticipated to listed salmonid species, marine mammals, or bald eagles in project vicinity.	• Same as Preferred Alternative.	• Similar to Preferred Alternative, with slightly reduced operation levels likely.
Mitigation Measures	• Helicopter flight elevations are being standardized by the OMP to avoid disturbance to nesting bald eagles. Trained marine mammal observers are used to ensure a clear range.	• Same as Preferred Alternative.	• Same as Preferred Alternative.

Table 2.4-1: Comparison of Environmental Impacts and Mitigation Measures for the Preferred Alternative, Dabob Bay Limited Alternative, and the No Action Alternative.

Affected Environment	Preferred Alternative	Dabob Bay Limited Alternative	No Action Alternative
Noise and Acoustics			
Environmental Impacts	• Most acoustic emissions would be at intensities below 180 dB, which would not adversely effect fish species. • Low frequency (LF) emissions would not adversely affect marine mammals as: (1) tests would not be conducted when whales are in the vicinity, and (2) tests that could affect marine mammals are infrequent.	• Similar to Preferred Alternative, with effects concentrated in Dabob Bay MOA.	• Similar to Preferred Alternative, with slightly reduced operation levels likely.
Mitigation Measures	• As no significant impacts are anticipated, no mitigation measures are proposed. • Navy will continue to conduct marine mammal surveys prior to tests, as required by the OMP.	• As no significant impacts are anticipated, no mitigation measures are proposed. • Navy will continue to conduct marine mammal surveys prior to tests.	• As no significant impacts are anticipated, no mitigation measures are proposed. • Navy will continue to conduct marine mammal surveys prior to tests.
Cultural Resources			
Environmental Impacts	• No known archaeological sites or Traditional Cultural Properties (TCPs) occur in MOAs. • There is potential to affect shipwreck sites during retrieval or cable-laying operations.	• Similar to Preferred Alternative, with effects concentrated in Dabob Bay MOA.	• Similar to Preferred Alternative, with slightly reduced operation levels likely.
Mitigation Measures	• If operations require bottom-disturbing activities near a shipwreck site, Navy will conduct a reconnaissance of the area; consultation with State Historic Preservation Officer (SHPO) will be conducted as necessary.	• Same as Preferred Alternative.	• Same as Preferred Alternative.

Table 2.4-1: Comparison of Environmental Impacts and Mitigation Measures for the Preferred Alternative, Dabob Bay Limited Alternative, and the No Action Alternative.

Affected Environment	Preferred Alternative	Dabob Bay Limited Alternative	No Action Alternative
Land and Shoreline Use			
Environmental Impacts	• No significant impacts to land and shoreline use in Kitsap and Jefferson counties.	• Same as Preferred Alternative.	• Same as Preferred Alternative.
Mitigation Measures	• As no significant impacts are anticipated, no mitigation measures are proposed.	• As no significant impacts are anticipated, no mitigation measures are proposed.	• As no significant impacts are anticipated, no mitigation measures are proposed.
Socioeconomics			
Environmental Impacts	• No significant impacts to population or income in Kitsap and Jefferson counties.	• Same as Preferred Alternative.	• Same as Preferred Alternative.
Mitigation Measures	• As no significant impacts are anticipated, no mitigation measures are proposed.	• As no significant impacts are anticipated, no mitigation measures are proposed.	• As no significant impacts are anticipated, no mitigation measures are proposed.
Recreation			
Environmental Impacts	• Minimal impacts to recreation resources. Recreational boaters required to wait during testing operations.	• Similar to Preferred Alternative, with effects concentrated in Dabob Bay MOA.	• Similar to Preferred Alternative, with slightly reduced operation levels likely.
Mitigation Measures	• As no significant impacts are anticipated, no mitigation measures are proposed.	• Same as Preferred Alternative.	• Same as Preferred Alternative.
Environmental Justice			
Environmental Impacts	• No significant impacts to minority or low income communities. • Minimal impacts to Tribal fishing patterns in Dabob Bay.	• Similar to Preferred Alternative, with effects concentrated in Dabob Bay MOA.	• Similar to Preferred Alternative, with slightly reduced operation levels likely.

Table 2.4-1: Comparison of Environmental Impacts and Mitigation Measures for the Preferred Alternative, Dabob Bay Limited Alternative, and the No Action Alternative.

Affected Environment	Preferred Alternative	Dabob Bay Limited Alternative	No Action Alternative
Mitigation Measures	• Navy will coordinate with affected Tribes to synchronize testing activity and Tribal fishing plans. • Coordination will include providing a weekly schedule of Range activity by time and place, as well as regular ongoing meetings.	• Same as Preferred Alternative.	• Same as Preferred Alternative.
Safety Hazards and Environmental Health Risks to Children			
Environmental Impacts	• No significant impacts to public safety, including children.	• Similar to Preferred Alternative, with effects concentrated in Dabob Bay MOA.	• Similar to Preferred Alternative, with slightly reduced operation levels likely.
Mitigation Measures	• As no significant impacts are anticipated, no mitigation measures are proposed.	• As no significant impacts are anticipated, no mitigation measures are proposed.	• As no significant impacts are anticipated, no mitigation measures are proposed.

[1] *Note to Reader: Refer to Section 3.0 for expanded analysis and mitigation measures.*

3.0 AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND MITIGATION MEASURES

The Preferred Alternative is to adopt the Dabob Bay OMP, establishing a comprehensive program for ongoing and future testing range operations to utilize the Dabob Bay MOA, the two Hood Canal MOAs, and connecting waters. The Limited Alternative analyzed in this EA is to utilize the Dabob Bay MOA only. The No Action Alternative would continue to allow each testing activity in the MOAs and connecting waters to conduct their own environmental review, as is currently done.

Data on the affected environment are provided below for the entire area encompassing the Dabob Bay MOA, the two Hood Canal MOAs, and connecting waters. Resources are identified in such a way as to distinguish between those in the Dabob Bay and Hood Canal MOAs. The environmental consequences of the Proposed Action are analyzed for all of the MOAs and connecting waters, as are the mitigation measures. Operations activities would be common to all three alternatives and are not divided by geographical area. The only activity that would occur in the connecting waters is the transiting of UUVs and an attendant vessel, as well as general vessel transiting to the ranges. This analysis provides a review of all the operations discussed in the OMP. The analysis compares the operations against environmental regulations to insure conformance or compliance. Impacts are discussed separately for the Dabob Bay Limited Alternative and the No Action Alternative.

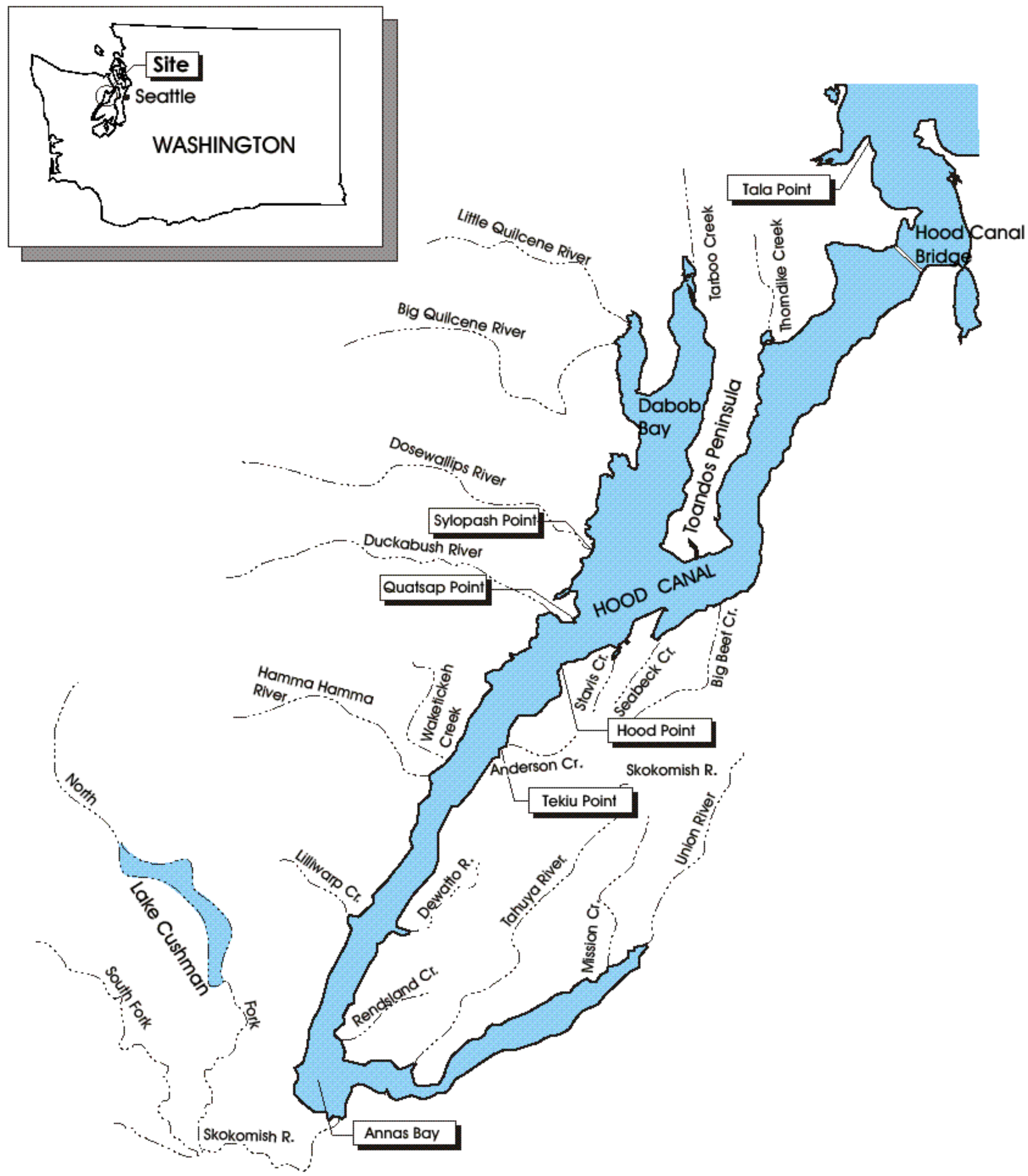
3.1 WATER QUALITY AND HYDROLOGICAL RESOURCES

This section reviews operations in relation to the Clean Water Act. Water quality and hydrological resources are discussed below, including background information on bathymetry, hydrology, and tidal currents. The following analysis shows that the Navy is in compliance for each of these areas.

3.1.1 Affected Environment

3.1.1.1 Bathymetry

The bathymetry of Dabob Bay and northern Hood Canal is complex and plays a major role in shaping local water circulation within the Hood Canal Basin. Glacial scouring formed the deep basin of Dabob Bay and carved a path south forming the main channel of Hood Canal to the Great Bend at Annas Bay (Figure 3.1-1) (Burns 1985). Northern Hood Canal from Tala Point to the tip of the Toandos Peninsula was excluded from the main axis of deep glacial scouring and is considerably more shallow (average depth of approximately 200 feet 61 m]) than the Dabob Bay Basin (maximum depth of



Source: NOAA, US NAVY

Environmental Assessment for the
Dabob Bay Operations and Management Plan
NUWC Division Keyport

Hood Canal and Related Hydrologic System

Figure 3.1-1

approximately 600 feet [183 m]). South of Dabob Bay, the water depth of the canal again increases between Hood Point and Tekiu Point, where it reaches a maximum depth of 590 feet (180 m).

Despite the inflow of the Big and Little Quilcene rivers, on a relative scale Dabob Bay lacks significant freshwater input at its head (Burns 1985). Consequently, there is little net seaward flow of surface water. This lack of freshwater input, the deep basin, and the presence of a controlling sill at the mouth all likely contribute to poor water exchange at depth between the bay and surrounding waters.

3.1.1.2 Hydrology

There are nine major river systems entering Hood Canal, as well as many smaller creeks and streams (Figure 3.1-1). In the northern Hood Canal and the DBRC, there are three major sources of freshwater input: (1) the Big and Little Quilcene rivers, which drain into Quilcene Bay; (2) the Dosewallips River, which empties out at Sylopash Point; and (3) the Duckabush River, which enters Hood Canal south of Quatsap Point. Smaller sources of freshwater input in the project area include Seabeck Creek, Big Beef Creek, and Thorndyke Creek.

In the Puget Sound area, precipitation and runoff exceed evaporation. The abundance of freshwater inputs and lack of evaporation cause surface salinities to decrease to a minimum in late winter and spring (Burns 1985). In the summer, decreased precipitation combined with seaward transport of low salinity surface water causes surface salinities to reach a maximum in late summer and early fall.

3.1.1.3 Tidal Currents

The mean tidal range within Dabob Bay is 7.6 feet (2.3 m) (Nautical Software Inc. 1993 – 1997).The tidal excursion (particle movement along a body of water associated with a single rise or fall of the tide) does not exceed 328 to 656 feet (100 to 200 m) within the bay, compared to 3.7 to 5 miles (6 to 8 km) at the entrance of Hood Canal between Tala Point and Hazel Point (Kollmeyer 1962). The result is that, in general, water stability and stratification are greatest in the upper 180 feet (55 m) within the still waters of Dabob Bay. Stability and stratification are weaker within the more turbulent approaches of Hood Canal.

Tides in the Hood Canal MOA have a mean range of approximately 7.2 feet (2.2 m) (Nautical Software Inc. 1993-1997). The highest tidal current velocities in northern Hood Canal occur between Tala Point and Hazel Point, in the vicinity of the Hood Canal MOA where current velocities can exceed 1.5 knots (kt) (0.8 m/s) (Island Canoe Inc. 1988). Water traveling through the Hood Canal entrance between Tala Point and Hazel Point can travel relatively quickly and with considerable turbulent mixing.

3.1.1.4 Water Quality

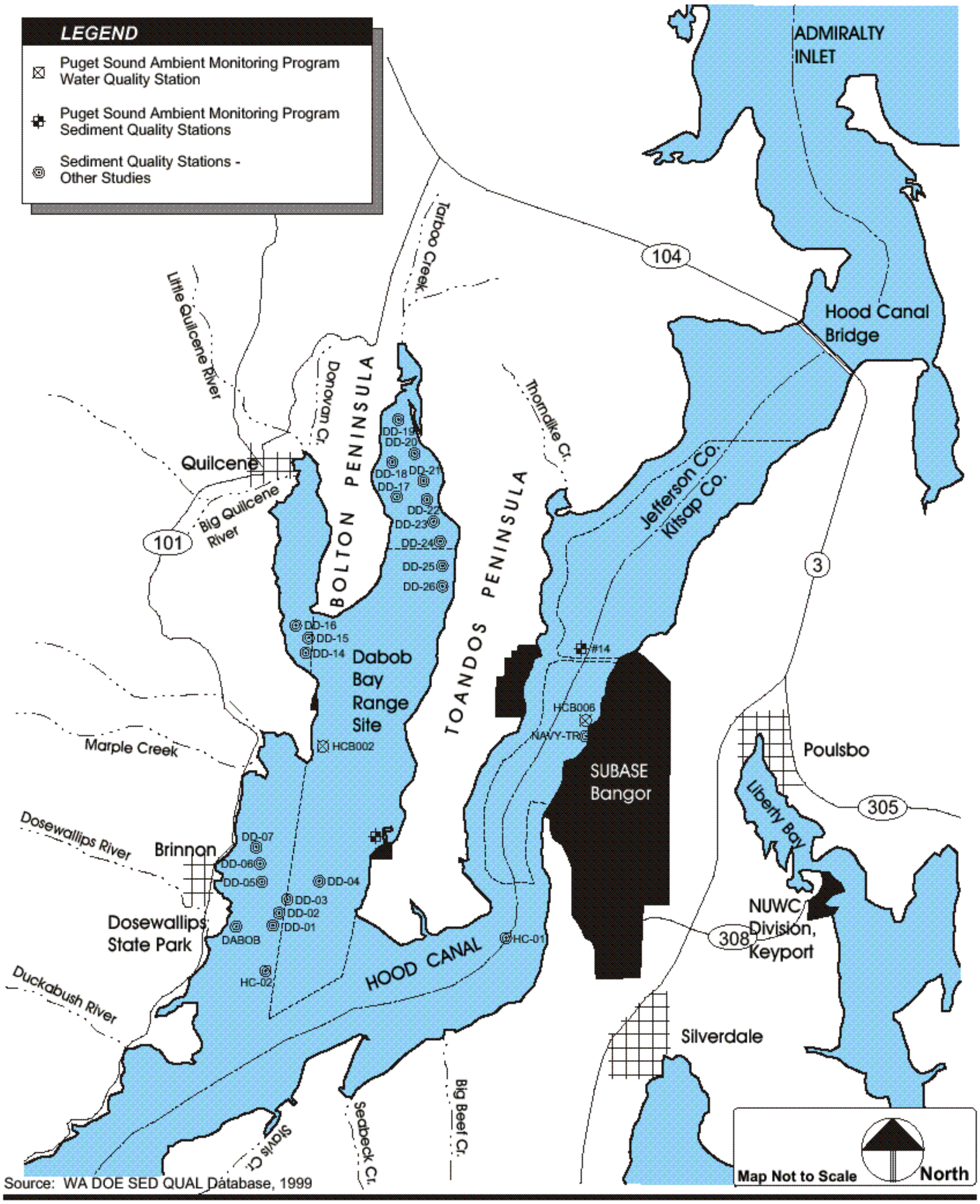
Water quality in the DBRC is measured by the Washington State Department of Ecology's (WDOE) Marine Water Quality Monitoring Program at two ambient monitoring stations (WDOE 1999b). These are Station HCB002, situated at mid-channel just offshore of Pulali Point in Dabob Bay, and Station HCB006 nearshore at King Spit in Hood Canal, near SUBASE Bangor (Figure 3.1-2). These stations are two of about 40 that are monitored on a monthly basis for a variety of parameters including temperature, light attenuation, Secchi disc depth, salinity, density, ammonium-N, nitrate, nitrite, orthophosphate-P, chlorophyll-a, phaeopigment, and fecal coliform bacteria. Under the Water Quality Standards for Surface Waters of the State of Washington (WAC Chapter 173-201A), the Hood Canal region including Dabob Bay is designated a Class AA (extraordinary) rating and therefore should exceed requirements for all beneficial uses listed in WAC 173-201A-030.

The Navy recently commissioned the Battelle Marine Sciences Laboratory (MSL) to conduct a field study to document current water and sediment quality conditions at the DBRC test range in Dabob Bay, and to assess potential impacts to water and sediment quality from decades of Navy use of the test range (Crecelius 2001). A copy of the study report is found in Appendix D.

In January of 2001, the Battelle MSL collected sediment and water samples in Dabob Bay on the DBRC test range. Surface sediment samples were collected at 14 stations on the bottom of Dabob Bay along the main axis of the DBRC test range (Figure 1 in Crecelius, 2001). Seawater samples were also collected at four of these stations at 1 meter below the surface and 10 meters above the bottom. The sediment and seawater samples were analyzed for cadmium (Cd), copper (Cu), lithium (Li), lead (Pb), zinc (Zn) and zirconium (Zr), elements identified as being present in torpedo exhaust, and /or anchor and dropper weights and other debris generated by operations at the DBRC.

Dabob Bay

Under Section 303(d) of the federal Clean Water Act, the WDOE is required to produce a list every two years of surface waters not expected to meet state water quality standards. Region WA-17-0010 located north of a line bearing 267º true from Tskutsko Point in Dabob Bay was placed on the 1998 Impaired and Threatened Waters list for fecal coliform violations. It is not clear what the source of the elevated fecal coliform is (Washington State Department of Health [WDOH] 1998; Puget Sound Water Quality Authority 1993). Range actions do not contribute to fecal coliform discharge in Dabob Bay. Zelatched Point has a properly operating septic system. Range craft have self-contained systems that do not discharge, per Navy policy, into any waters.



Environmental Assessment for the
Dabob Bay Operations and Management Plan
NUWC Division Keyport

Sediment Quality and Water Quality Sampling Stations

Figure 3.1-2

Laboratory analysis results for both the surface and bottom seawater samples collected by the Battelle MSL indicate that metal analytes were present at low levels in Dabob Bay, comparable to background levels present in non-urban portions of Puget Sound (see Tables 7 and 9 in Crecelius, 2001). The four metals (Cd, Cu, Pb, and Zn) with listed Washington State water quality criteria, had concentrations well below these criteria. Lithium and zirconium do not have Washington State water quality criteria, but the lithium concentrations present were at the same level as those naturally occurring in the ocean. The zirconium concentrations observed were well below levels considered toxic to aquatic organisms.

Hood Canal

Region WA-PS-0100 constitutes Hood Canal north and was considered for listing in the Impaired and Threatened Surface Waters report under Section 303(d). Excursions of temperature and dissolved oxygen (DO) for station HCB006 between 1991 and 1996 were observed but were attributed to natural conditions from upwelling and solar heating, and consequently were not placed on the list. Values of 4.6 mg/L DO were detected on September 14 1998, well below the water quality criterion of 7.0 mg/L. A separate document released in December 1998 by the Marine Water Quality Monitoring Division evaluated the values of some of the water quality parameters discussed above and designated areas susceptible to eutrophication (an increase in nutrients and plankton blooms leading to low dissolved oxygen levels) (Newton et al. 1998). Dissolved oxygen was used as one indicator of eutrophication. According to this review, Station HCB006 in the Hood Canal MOA exhibited DO levels consistent with biological stress (<5 mg/L).

3.1.2 Environmental Consequences

3.1.2.1 Preferred Alternative

Potential Water Quality Effects

Potential water quality effects of operations conducted under the OMP at the DBRC can be categorized as: (1) torpedo exhaust gas releases into the water; (2) accidental spills of fuel oil, torpedo propellants, and other substances; (3) increased turbidity arising from seabed disturbance during recovery of buried torpedoes and other devices; and (4) potential heavy metal leaching into sediments and the water column from lead anchors and copper core guidance wire on the sea bottom (MAKERS 1999). Each of these is analyzed separately below.

Water quality samples collected by the Battelle MSL on the surface and off the bottom of Dabob Bay on the DBRC test range indicate that analyzed metals (Cd, Cu, Pb, Zn, Li, and Zr) are not present at elevated levels (Crecelius 2001). Metal concentrations are comparable to background levels present in non-urban portions of Puget Sound, and are either well below Washington State water quality criteria (Cd, Cu, Pb and Zn), at naturally occurring levels (Li) or are well below levels considered toxic to aquatic organisms (Zr).

Exhaust Releases

The majority of underwater vehicle exhaust gas components would quickly dissipate in the water column and would not require tidal action to reach non-toxic levels. There are no studies in the published scientific literature that discuss the specific components of the test torpedoes in a similar test setting. Applicable studies in the scientific literature and known toxicology data are used for comparative purposes in the following discussion.

Otto Fuel II Powered Torpedoes - Otto Fuel II is a monopropellant used in MK 46, MK 48, and other torpedoes (Royal Military College [RMC] and University of British Columbia [UBC] 1996). Otto Fuel combustion products present in torpedo exhaust are listed in Table 3.1-1, and include carbon monoxide, water, methane, carbon dioxide, nitrogen gas, nitrogen dioxide, hydrogen gas, miscellaneous hydrocarbons, and hydrogen cyanide (NUWC 1994). A total of 53 lbs (24.85 kg) of exhaust constituents are produced in a single run of the MK 46 torpedo, 335 lbs (150.75 kg) are produced by the MK 48 torpedo, and 506 lbs (227.7 kg) are produced by the MK 48 ADCAP (Advanced Capacity) torpedo (NUWC 1994).

Table 3.1-1: Exhaust component list for Otto Fuel II propelled torpedoes.

Exhaust Constituent	Percent	MK 46 (lbs)	MK46 (kg)	MK 48 (lbs)	MK 48 (kg)	MK 48 ADCAP (lbs)	MK 48 ADCAP (kg)
Carbon monoxide	38.0%	20.14	9.06	127.3	57.28	192.28	86.53
Water	20.0%	10.60	4.77	67.0	30.15	101.20	45.54
Methane	11.0%	5.83	2.62	36.85	16.58	55.66	25.05
Carbon dioxide	9.5%	5.04	2.27	31.82	14.32	48.07	21.63
Nitrogen	8.7%	4.61	2.07	29.14	13.11	44.02	19.81
Nitrogen dioxide	8.0%	4.24	1.91	26.80	12.06	40.48	18.22
Hydrogen	4.0%	2.12	0.95	13.40	6.03	20.24	9.11
Hydrocarbons	0.5%	0.26	0.12	1.67	0.75	2.53	1.14
Hydrogen cyanide	0.3%	0.16	0.07	1.00	0.45	1.52	0.68
Total amount per run	100.0%	53.0	23.85	335.0	150.75	506.0	227.7

Source: NUWC 1994

Exhaust Gases - The exhaust components likely released in gaseous form include carbon monoxide, methane, carbon dioxide, nitrogen, nitrogen dioxide, hydrogen, and miscellaneous hydrocarbons. Carbon dioxide is the most soluble of these gases in water (Lide 1991; Stumm and Morgan 1996). Some proportion of the carbon dioxide gas would react with water to form carbonic acid and other components of the carbonate system, the ionic forms of which are natural constituents of seawater (Stumm and Morgan 1996). The rest of the carbon dioxide would be released into the air. Thus, the release of this gas would have no adverse effects on aquatic organisms.

The remaining exhaust gases released from Otto Fuel II powered torpedoes (carbon monoxide, methane, nitrogen, nitrogen dioxide, hydrogen, and miscellaneous hydrocarbons) do not react or ionize in seawater and have low solubility in water (Lide 1991; Stumm and Morgan 1996). With the possible exception of carbon monoxide, these gases would eventually escape into the atmosphere. A study of exhaust emissions from two- and four-stroke outboard engines, which emit exhaust into the water, found that: "the emitted gases [CO, NO_x, and HC], which are very volatile and have poor solubility in water, are stripped by the intense gas flow from the water and are finally introduced into the air" (Juttner et al. 1995). Since this study examined exhaust releases from engines mounted on test stands in very shallow water, the process described may be delayed by exhaust releases in deep water.

One recent study indicates that high concentrations of carbon monoxide in water can cause fish kills (Kempinger et al. 1998). Major fish kills were linked to the release of carbon monoxide into the Fox River in Wisconsin from exhaust produced by an outboard motor testing facility. The facility ran many outboard engines simultaneously for long periods of time each day. Thus, carbon monoxide levels built up in the limited dilution water available in the river, before being released into the atmosphere. The authors of the study drew their conclusions from measurements of carbon monoxide bound to hemoglobin in the blood of the killed fish, and did not measure carbon monoxide concentrations in the water. These measurements were not taken due to the fact that "no instrument existed that directly measures CO in water."

In comparison, it is unlikely that carbon monoxide releases from Otto Fuel II powered torpedoes would result in fish kills as the releases are: (1) limited in number; (2) limited in duration to the time of individual test runs; (3) emitted over the entire 14,000-yard (12,796 m) length of a test run, which effectively dilutes carbon monoxide concentrations to very low levels at any one location; (4) diluted into the large amount of water available for dilution and mixing in Dabob Bay or Hood Canal, as opposed to the limited dilution water available in a river; and (5) only temporarily in the water column before being released into the atmosphere.

Hydrogen Cyanide - The exhaust components likely present in either liquid and/or gaseous form include water, and hydrogen cyanide. While water would obviously dissipate quickly into the surrounding seawater with no toxic effects, hydrogen cyanide is very soluble and toxic to marine organisms at certain concentrations (Lide 1991; PSEP 1991). The federal and Washington State water quality criterion for protection of marine organisms from acute toxicity from hydrogen cyanide is 1.0 μg/L or parts per billion (ppb)(EPA, 1991; Chapter 173-201A Washington Administrative Code [WAC]). This criterion is defined as a "1-hour average concentration not to be exceeded more than once every three years on the average". However, the state acute criterion for cyanide is higher (less restrictive) in waters roughly east of Rosario Strait and south of the entrance to Admiralty Inlet, which includes the waters of Hood Canal and Dabob Bay. The state marine acute water quality criterion for cyanide in these waters is 9.1 µg/L or ppb. The long test run distance (14,000 yards [12,796 m]) of the Otto Fuel II powered torpedoes will effectively dilute the exhaust component concentrations to very low levels, which will quickly dissipate to levels below the water quality criterion for cyanide.

The amount of hydrogen cyanide released during a single test run of the MK 46 torpedo is 0.16 lb (71.55 g). If this amount of cyanide is distributed along the entire 14,000 yard (12,796 m) test run distance, 0.005592 grams would be released in each linear meter of the run. If this amount of hydrogen cyanide were diluted into 1 cubic meter of water at that spot, a concentration of 5.59 ppb would be initially present at each linear meter of the test run. This amount is below the less restrictive state criterion of 9.1 ppb, but exceeds the federal criterion of 1.0 ppb. If the 0.005592 g is dissipated into 5.59 cubic meters of water, this criterion will be met. This volume of water would be contained in a 1-meter wide cylinder of water with a radius of 4.36 feet (1.33 m).

The amount of hydrogen cyanide released during a single test run of the MK 48 torpedo is 1.01 lbs (452.25 g). If this amount of cyanide is distributed along the entire 14,000 yard (12,796 m) test run distance, 0.035343 grams would be released in each linear meter of the run. If this amount of hydrogen cyanide were diluted into 1 cubic meter of water at that spot, a concentration of 35.34 ppb would be initially present at each linear meter of the test run. This amount exceeds both the federal criterion of 1.0 ppb and the less restrictive state criterion of 9.1 ppb. If the 0.035343 g is dissipated into 35.34 cubic meters of water, the 1.0 ppb criterion will be met. This volume of water would be contained in a 1-meter wide cylinder of water with a radius of 10.99 feet (3.35 m). If the 0.035343 g is dissipated into 3.88 cubic meters of water, the 9.1 ppb criterion will be met. This volume of water would be contained in a 1-meter wide cylinder of water with a radius of 3.64 feet (1.11 m).

The amount of hydrogen cyanide released during a single test run of the MK 48 ADCAP torpedo is 1.52 lbs (683.1 g). If this amount of cyanide is distributed along the entire 14,000 yard (12,796 m) test run distance, 0.053384 grams would be released in each linear meter of the run. If this amount of hydrogen cyanide were diluted into 1 cubic meter of water at that spot, a concentration of 53.38 ppb would be initially present at each linear meter of the test run. This amount exceeds both the federal criterion of 1.0 ppb and the less restrictive state criterion of 9.1 ppb. If the 0.053384 g is dissipated into 53.38 cubic meters of water, the 1.0 ppb criterion will be met. This volume of water would be contained in a 1-meter wide cylinder of water with a radius of 13.51 feet (4.12 m). If the 0.053384 g is dissipated into 5.87 cubic meters of water, the 9.1 ppb criterion will be met. This volume of water would be contained in a 1-meter wide cylinder of water with a radius of 4.49 feet (1.37 m).

It is likely that these amounts of dilution would be quickly achieved given tidal current mixing available in the DBRC and the active dispersion of the exhaust into a plume behind the torpedoes. It is also likely that concentrations of cyanide at any one location of a test run would be below criteria if averaged over one hour (as per the above definition), as the torpedo passes through each linear meter of the test run very quickly. Hydrogen cyanide does not bioaccumulate to any significant degree. Hydrogen cyanide in low (non toxic) concentrations is biodegradable by almost all organisms (PSEP 1991).

A study of potential torpedo exhaust gas impacts to water quality was recently conducted at the Canadian Forces Maritime Experimental Test Ranges (CFMETR) at Nanoose, British Columbia (RMC and UBC 1996). In this study, water samples of torpedo wake water and gas bubble plumes were collected at various depths up to 75 feet (23 m) and analyzed for Otto Fuel and hydrogen cyanide (one component of Otto Fuel exhaust). Samples were taken immediately after the passage of a torpedo and at 10, 20, and 30 minutes after passage, respectively. Neither Otto Fuel nor hydrogen cyanide was detected in any of the samples at or above the achievable laboratory detection limits of 1 ppb and 5 ppb, respectively. This study concluded that chemical and oceanic mixing processes present in the environment reduced concentrations of these toxicants to below detection limits and that environmental impacts were negligible.

Field observations by NUWC Division Keyport personnel indicate that for torpedoes tested in waters less than 100 feet deep in calm waters, a visible plume or path of gas bubbles appears on the surface approximately 30 seconds after a torpedo passes through an area. When the bubble path first appears it is approximately 2 feet wide, growing to a width of approximately 6 feet wide in about 5 minutes. The bubbles then dissipate completely over another 2 to 3 minutes. The presence of wind waves on the water speeds up the spreading and dissipation process.

This visible gas bubble plume or path created in the wake of passing torpedoes represents a zone of initial dilution for torpedo exhaust products, which is quickly achieved. Most, if not all the dilution process required to meet the state water quality criterion of 9.1 ppb for hydrogen cyanide released in the exhaust of the three torpedo types discussed above, would be achieved during the first 5 minutes of this initial dilution process. This initial dilution would conservatively take place in a six-foot (1.83 m) diameter or 3 foot (0.91 m) radius cylinder of water centered on the axis of the torpedo path, based on the field observations above. This volume of water would actually quickly rise to the surface and likely change shape providing even more initial dilution volume. A somewhat longer time would be required to meet the federal water quality criterion of 1.0 ppb, but this will very likely be accomplished in a short enough time period to meet the one hour average concentration part of the water quality criteria regulations.

Underwater Vehicles Powered by the Exotic Rocket Motor Propulsion System - Table 3.1-2 shows the maximum amount of individual exhaust components that would be released during a single test run of underwater vehicles powered by the 'exotic' rocket motor propulsion system. The exhaust products are released in two conical plumes behind the vehicle. No more than 12 of these test runs would be conducted annually. These exhaust components are released over the course of 14,000-yard (12,796 m) test runs. The fact that exhaust is released continuously over this distance effectively dilutes the exhaust component concentrations to very low levels at any one location of the test run distance. Infrequent stationary tests of this propulsion system, which would release approximately 60 percent of the amounts in Table 3.1-2, are also planned. The two conical plumes of exhaust products produced during these tests would each be approximately 25 feet (7.62 m) long. Stationary tests would be conducted twice a year on average and would consist of running the propulsion system for 10 seconds each time.

Table 3.1-2: Exhaust component list for 'exotic' rocket motor propulsion system.

Species		Weight (lbs)	Probable Form
Carbon	C	0.4276	solid
Carbon monoxide	CO	36.1117	gas
Carbon dioxide	CO2	4.7100	gas
Ethane	C2H6	0.0002	gas
Methane	CH4	0.9514	gas
Hydrogen chloride	HCl	44.4385	gas
Iron chloride	FeCl2	0.0760	solid
Hydrogen	H2	2.7501	gas
Water	H2O	33.0095	liquid
Hydrogen cyanide	HCN	0.0002	gas/liquid
Nitrogen	N2	17.8197	gas
Ammonia	NH3	0.0040	gas/liquid
Zirconium oxide	ZrO2	1.2343	solid
Total		171.5333	

Exhaust Gases - The exhaust components likely released in gaseous form include carbon monoxide, carbon dioxide, ethane, methane, hydrogen chloride, hydrogen, and nitrogen. Effects from these exhaust gases would be similar to those previously described above for Otto Fuel II. The following discussion highlights those effects that are different than discussed under Otto Fuel II.

Hydrogen Cyanide and Ammonia - The federal and Washington State water quality criterion for protection of marine organisms from acute toxicity from hydrogen cyanide is 1.0 µg/L or parts per billion (ppb) (EPA 1991; Chapter 173-201A Washington Administrative Code [WAC]). This criterion is defined as a "1-hour average concentration not to be exceeded more than once every three years on the average." However, the state acute criterion for cyanide is higher (less restrictive) in waters roughly east of Rosario Strait and south of the entrance to Admiralty Inlet, which include the waters of Hood Canal and Dabob Bay. The state marine acute water quality criterion for cyanide in these waters is 9.1 μg/L or ppb. The amount of hydrogen cyanide released during a single test run is 0.0002 lb (0.091 g). If this amount is distributed along the entire 14,000-yard (12,796 m) test run distance, 0.000007112 gram would be released in each linear meter of the run. If this amount of hydrogen cyanide were diluted into 1 cubic meter of water, a concentration of 0.007112 ppb would be present at each linear meter of the test run, which is well below both the federal and state water quality criterion of 1 ppb and the higher state criterion of 9.1 ppb for waters south of the mouth of Admiralty Inlet, including Hood Canal and Dabob Bay.

Sixty percent of the 0.091 grams of hydrogen cyanide released during a test run, or 0.055 gram, would be released during a stationary test of the 'exotic' propulsion system. To reach the water quality criterion level of 1 ppb, this amount of hydrogen cyanide would need to be diluted into approximately 55,000 liters or 55 cubic meters of water. This volume of water would be contained in two 25 foot (7.62 m) long cones, each with a base radius of 6.09 feet (1.86 m). To reach the higher water quality criterion level of 9.1 ppb, 0.055 gram of hydrogen cyanide would need to be diluted into approximately 6,044 liters or 6.044 cubic meters of water. This volume of water would be contained in two 25 foot (7.62 m) long cones, each with a base radius of 2.02 feet (0.61 m). It seems likely that these amounts of dilution would be quickly achieved given the short duration of the test and the active dispersion of the exhaust from the underwater vehicle into a plume surrounding the vehicle. It is also likely that concentrations of hydrogen cyanide would be below the one-hour criteria.

Ammonia in seawater is present in both ionized (NH_4^+) and un-ionized (NH_3) forms, the ratio depending on ambient seawater salinity, temperature, and pH (EPA 1989). The un-ionized form is toxic to aquatic organisms. The water quality criterion for ammonia thus changes according to ambient conditions. Representative salinity, temperature, and pH values for Dabob Bay of 28 parts per thousand (ppt), 13°C, and 8.4 were chosen, respectively, from water quality data collected by the Washington State Department of Ecology (WDOE) at Station HCB002 in Dabob Bay on May 11, 1987 (WDOW 1999b; no data available for this station after 1987 or in winter months). Given these ambient values, the federal and state water quality criterion for acute toxicity from total ammonia (total for both forms) would be 4.89 mg/L or parts per million (ppm), as calculated in spreadsheets produced by WDOW (WDOE 1999c). It is also likely that concentrations of ammonia would be below criteria if averaged over one hour (as per the above definition), because the system is tested for only 10 seconds.

The amount of ammonia released during a single test run is 0.004 lb (1.81 grams). If this amount is distributed along the entire 14,000-yard (12,796 m) test run distance, 0.00014 gram would be released in each linear meter of the run. If this amount of ammonia were diluted into 1 cubic meter of water, a concentration of 0.00014 ppm would be present at each linear meter of the test run, which is well below the water quality criterion of 4.89 ppm.

Sixty percent of the 1.81 grams of ammonia released during a test run, or 1.086 grams, would be released during a stationary test of the ‘exotic’ propulsion system. To reach the water quality criterion level of 4.89 ppm, this amount of ammonia would need to be diluted into approximately 222 liters or 0.222 cubic meters of water. This volume of water would be contained in two 25 foot (7.62 m) long cones, each with a base radius of 0.39 feet (0.12 m). It is likely that this amount of dilution would be quickly achieved given tidal current mixing available in the DBRC and the active dispersion of the exhaust from the underwater vehicle into a plume surrounding the vehicle.

Iron Chloride and Zirconium Oxide - The exhaust components likely present in solid (or dissolved particulate) form include carbon, iron chloride, and zirconium oxide. Elemental carbon is insoluble and unlikely to be toxic to marine organisms (Lide 1991). Iron chloride is soluble in water and toxic to marine organisms at various concentrations (Lide 1991; EPA 2000). Zirconium oxide is insoluble in water, with no toxicity data available in the comprehensive EPA ECOTOX database. However, “the inherent toxicity of zirconium compounds is low” (Lide 1991). No federal or state water quality criteria exist for iron chloride or zirconium oxide (EPA 1991; Chapter 173-201A WAC). The long test run distance (14,000 yards [12,796 m]) of the underwater vehicle using the ‘exotic’ propulsion system would effectively dilute these exhaust components.

The most relevant toxicity data in the EPA ECOTOX database available for iron chloride were from a study where 100 percent mortality was observed in rainbow trout (*Oncorhynchus mykiss*) for a 21 day exposure to a concentration of 3,400 μg/g or ppm iron chloride (Goettl and Davies 1977). Five percent of this level, or 170 ppm, was chosen as representative of a concentration causing low or no toxicity to rainbow trout.

The amount of iron chloride released during a single test run is 0.076 lb (34.47 grams). If this amount is distributed along the entire 14,000-yard (12,796 m) test run distance, 0.00269 gram would be released in each linear meter of the run. If this amount of iron chloride were diluted into 1 cubic meter of water, a concentration of 0.00269 ppm would be present at each linear meter of the test run, which is well below the chosen low toxicity concentration of 170 ppm.

Sixty percent of the 34.47 grams of iron chloride released during a test run, or 20.68 grams, would be released during a stationary test of the ‘exotic’ propulsion system. To reach the low toxicity level of 170 ppm, this amount of iron chloride would need to be diluted into approximately 121.6 liters or

0.1216 cubic meters of water. This volume of water would be contained in two 25 foot (7.62 m) long cones, each with a base radius of 0.29 feet (0.09 m). It is likely that this amount of dilution would be quickly achieved given the short duration of the test and the active dispersion of the exhaust from the underwater vehicle into a plume surrounding the vehicle.

Although no toxicity data are available for zirconium oxide, there are data for elemental zirconium toxicity to coho salmon (*Oncorhynchus kisutch*) (EPA 2000). In a study by Peterson et al. (1974), 0 percent mortality was observed at a concentration varying from 1,000 to 15,000 ppm zirconium. A concentration of 1,000 ppm was chosen as representative of zero toxicity for zirconium oxide.

The amount of zirconium oxide released during a single test run is 1.2343 lbs (559.87 grams). If this amount is distributed along the entire 14,000-yard (12,796 m) test run distance, 0.0437 gram would be released in each linear meter of the run. If this amount of zirconium oxide were diluted into 1 cubic meter of water, a concentration of 0.0437 ppm would be present at each linear meter of the test run, which is well below the zero toxicity concentration of 1,000 ppm.

Sixty percent of the 559.87 grams of zirconium oxide released during a test run, or 335.92 grams, would be released during a stationary test of the ‘exotic’ propulsion system. To reach the zero toxicity level of 1,000 ppm, this amount of zirconium oxide would need to be diluted into approximately 335.92 liters or 0.336 cubic meters of water. This volume of water would be contained in two 25 foot (7.62 m) long cones, each with a base radius of 0.48 feet (0.14 m). It seems likely that this amount of dilution would be quickly achieved given the short duration of the test and the active dispersion of the exhaust from the underwater vehicle into a plume surrounding the vehicle.

The recent study conducted by the Battelle Marine Sciences Laboratory indicated that water quality samples taken at four stations along the axis of the Dabob Bay test range at 1 meter below the surface and 10 meters above the bottom did not contain elevated levels of zirconium (Crecelius 2001). Washington State does not list a water quality criterion for zirconium. However, the zirconium concentrations found were four orders of magnitude below the lowest effect concentration considered toxic to aquatic organisms.

Summary - As demonstrated above, the long test run distance (14,000 yards [12,796 m]) of the underwater vehicle using the ‘exotic’ propulsion system will effectively dilute these exhaust components to very low levels causing no adverse effects to marine organisms. In addition, these tests would be conducted no more than 12 times per year, thus producing no cumulative or long-term effects.

Any potential adverse effects to marine organisms from infrequent stationary tests conducted with this propulsion system would be temporary in nature and limited to an area contained within two 25 foot (7.62 m) cones of water, behind the test vehicles, each with a base radius of 6.09 feet (1.86 m) at most. This volume of water would be required to dilute hydrogen cyanide, the most toxic exhaust component, to the federal and state acute water quality criterion concentration of 1 ppb. If the higher state acute criterion level for cyanide of 9.1 ppb is used, for waters south of the mouth of Admiralty Inlet, potential adverse effects would be limited to two 25 foot (7.62 m) cones of water, each with a base radius of 2.02 feet (0.61 m), at most. It seems likely that these amounts of dilution would be quickly achieved given the short duration of the test and the active dispersion of the exhaust from the underwater vehicle into a plume surrounding the vehicle.

SCEPS Powered Torpedoes - Torpedoes powered by the SCEPS include the MK 50 torpedo. This propulsion system uses heat generated by an exothermic reaction. Only heat is released to the environment, as the reaction products are contained within the torpedo due to the nature of this closed system.

Torpedoes Powered by Other Propulsion Systems - The Navy is working on developing alternative torpedo propulsion systems that may use a variety of experimental/exotic fuels. Until prototypes are available, the final design and fuel systems cannot be fully analyzed. Current research indicates that these systems may include variations of SCEPS fuel, JP-5, rocket fuel, or other fuels. Variations of the SCEPS fuel system are generally expected to have similar effects as those of the MK 50 torpedo testing. Other fuel systems cannot be fully analyzed until the fuel components are defined. When these fuels are defined there will be individual environmental analysis done before the system is tested.

Accidental Fuel Oil and Propellant Spills

Fuel oil and hazardous substance spills can degrade water quality and be lethal or injurious to many marine organisms, depending on the amount and type of substance spilled (Malins 1977; National Research Council 1985). No intentional releases of fuel oil or torpedo propellant are integral to DBRC operations. Navy policy for all of its vessels is to eliminate or reduce the chance of spills during operations at sea. In the event of an accidental release of fuel oil or other hazardous substance during surface ship or shoreside activities of range operations, contingency plans developed by the Navy are followed that provide instructions on proper spill notification and response actions (Naval Submarine Base Bangor 1998).

The spill history in Table 3.1-3 indicates that during the subject time period, no significant spills of fuel oil or other hazardous substances have been associated with DBRC.

Table 3.1-3: Spill history at K/B Pier at SUBASE Bangor associated with DBRC Operations.

Date	Spill location	Amount	Substance
12/10/97	land	2 quarts	hydraulic fluid
12/14/98	land	½ gallon	Otto Fuel II
9/3/99	land	1 pint	antifreeze
9/20/99	land	2 quarts	hydraulic fluid

Source: ROC, Comfort, 2000

No explosive tests of torpedoes are conducted within the Dabob Bay and Hood Canal MOAs. Tests are conducted with torpedo warheads removed and replaced with test instrument packages. It is possible that an accidental torpedo propellant release may occur during a target strike (MAKERS 1999). Normally, torpedoes are programmed to avoid direct target hits, but some impact tests have been conducted with MK 50 torpedoes (powered by the SCEPS and Otto Fuel II powered torpedoes) for verification (approximately 10 per year). Normally, the torpedo propellants would not be released even in the event of an impact that fractured the outer case of the torpedo.

Propellant Release from a Complete Rupture of an Otto Fuel II Powered Torpedo

The maximum amount of Otto Fuel II released in the event of a complete torpedo rupture during an impact test would be approximately 60 lbs (27.22 kg) as that is the maximum fuel that would be remaining in a weapon at the end of the run. There is no federal or Washington State water quality criterion for Otto Fuel II (EPA 1991; Chapter 173-201A WAC). Otto Fuel II has been found to be toxic to several marine organisms: (1) a 48-hour Median Effective Concentration (MEC_{50}) of 5.0 ppm fuel produced mortality and paralysis for pink shrimp (*Penaeus duorarum*), and (2) a 48-hour Median Lethal Concentration (MLC_{50}) of 3.2 ppm fuel was found to be lethal for spot (*Leiostomus xanthurus*; a fish species) (Continental Shelf Associates 1977). A propellant release from a complete torpedo rupture would be considered to be a spill, initiating actions covered under Navy contingency and spill response plans.

In the event of a complete Otto Fuel II release from a ruptured torpedo, concentrations of Otto Fuel II would be diluted and dispersed by oceanic mixing processes to non-toxic concentrations. For this analysis, 10 percent of the MLC_{50} for spot of 3.2 ppm, or 0.32 ppm, is used as representative of low or no toxicity. To reach this concentration, the 27.22 kg (or 22.09 liters) of Otto Fuel II released would need to be diluted into approximately 69,034,375 liters or 69,034 cubic meters. This volume of water would be contained in a sphere with a radius of 83.48 feet (25.45 m). It seems likely that this level of dilution would be achieved relatively quickly, given ambient mixing and dispersion. However, a release of Otto Fuel II would cause temporary, localized toxicity effects to marine organisms prior to dilution to non-toxic levels.

As the probability of accidental fuel oil or torpedo propellant spills is very low (historically 1 percent) during routine range operations, it is unlikely that water quality would be significantly affected. Actions specified under Navy contingency and spill response plans would reduce the potential impacts of any such spill. The Navy has developed a “Spill Prevention Control and Countermeasures (SPCC) Oil Pollution Plan” for all its operations as required in OPNAVINST 5090.1B, Chapter 19. The SPCC plan identifies measures and practices to be taken to reduce the potential for an oil spill to occur on soils or navigable waters of the United States. The Navy has also developed an “Oil and Hazardous Substance (OHS) Release Contingency and Response Plan” to address the control, containment and cleanup of oil and hazardous substances as required by OPNAVINST 5090.1B, Chapter 10. The OHS plan identifies actions to be taken to reduce the impact of a propellant or fuel oil spill which may occur as a result of Navy operations.

SCEPS Propellant Release from a Complete Torpedo Rupture

The maximum amount of SCEPS propellant chemicals released in the event of a complete MK 50 torpedo rupture would be approximately 10 pounds (4.5 kg) of lithium and 10 lbs (4.5 kg) of sulfur hexafluoride (MAKERS 1999). Possible reaction byproducts released (in lower amounts) in the case of a complete SCEPS torpedo rupture include potassium chloride, lithium carbide, lithium carbonate, lithium chloride, lithium fluoride, lithium hydride, lithium hydroxide, and lithium sulfide.

While no EPA or Washington State water quality criteria exist for lithium, sulfur hexafluoride, or any of the reaction byproducts, lithium, potassium chloride, lithium chloride, and lithium carbonate can be toxic to aquatic and marine organisms at certain concentrations, based on data in the comprehensive EPA ECOTOX aquatic toxicity database (EPA 1999). No toxicity data are available in the database for the other reaction byproducts.

Lithium is slightly toxic to aquatic organisms, with a 96 hour LC_{50} (lethal concentration resulting in 50 percent mortality of test organisms) in fathead minnows (*Pimephales promelas*) of 42 mg/L and a No Observed Effect Concentration (NOEC) of 13 mg/L (Long et al. 1998). No aquatic toxicity information was located for sulfur hexafluoride, but this compound is widely used as a tracer chemical in oceanographic and atmospheric experiments (King and Saltzman 1995). Lithium carbonate has been found to be toxic to mummichog (*Fundulus heteroclitus*; a fish species) at a 96-hour LC_{50} of 39 mg/L (Dorfman 1977). Lithium chloride is chronically toxic to fathead minnow larvae, with a 26-day LC_{50} of 8.7 mg/L and a NOEC of 1.2 mg/L (Long et al. 1998).

In the event of a complete SCEPS propellant release, concentrations of these substances would quickly be diluted and dispersed by oceanic mixing processes to non-toxic concentrations. If the NOEC of 13 mg/L of lithium for fathead minnows is accepted as representative of the sensitivity of marine organisms in Dabob Bay, the maximum accidental release of 10 lbs (4.5 kg) of lithium would need to be diluted into a volume of seawater which could be contained in a sphere of water with a radius of 14.1 feet (4.3 m) to achieve the NOEC concentration. Tidal and wind-induced currents and water movements in Dabob Bay and northern Hood Canal should provide this level of dilution in a short time period, likely within several hours. It is unlikely that any marine organisms, including fish, would be present in the immediate vicinity and at the exact time of an accidental rupture. If present, they would be very unlikely to remain in the vicinity of the spilled chemicals long enough for any toxic effects to occur (i.e., 96 hours or 26 days). Such an accidental release would cause a short-term toxic hazard to marine life in the immediate vicinity prior to dilution to non-toxic levels.

The recent study conducted by the Battelle Marine Sciences Laboratory indicated that water quality samples taken at four stations along the axis of the Dabob Bay test range at 1 meter below the surface and 10 meters above the bottom did not contain elevated levels of lithium (Crecelius 2001). Washington State does not list a water quality criterion for lithium. However, the lithium concentrations found are comparable to those occurring naturally in the ocean.

Increased Turbidity from Seabed Disturbance

Temporary increases in water column turbidity arising from seabed disturbance can occur during the retrieval of torpedoes and other devices from the sea bottom as part of range operations. Retrievals of torpedoes or other devices from the sea bottom are infrequent, occurring less than 14 times per year (MAKERS 1999). In about half of these retrievals (or about 7 times a year), torpedoes may embed themselves in the soft bottom sediments, requiring that they be washed out using pressure-washing systems to clear away the soft bottom sediments. The majority of embedded torpedo recoveries would disturb the surface of the seabed within a circular area with an approximate radius of 15 feet (4.6 m), or 707 square feet (66 m^2). Within this area, a volume of sediments would be disturbed approximating a hemisphere in shape, with a 15-foot (4.6 m) radius, or 524 cubic yards (400 m^3) of sediment. Torpedoes have rarely been known to bury themselves as deep as 28 feet (8.5 m) measured to the tail, although this represents the extreme, happening approximately once every five years.

The sediments disturbed during these recovery operations would quickly settle back to the bottom. Observations of torpedo recoveries in Dabob Bay indicate that it takes approximately 2 hours for disturbed sediment to completely settle to the bottom. This is consistent with Bowen (1976), in a computer modeling study of dredged material disposal, who estimated that 77 percent of a 310 cubic yard (237 m^3) volume of sediments dropped in 50 feet (15.2 m) of water would settle to the bottom within 25 minutes. Similar settlement volume percentages were obtained ranging from 82 to 78 percent for sediment volumes from 4.9 to 2,479 cubic yards (3.7 to 1,895 m^3). Such an event would temporarily exceed turbidity standards around the excavator, but this is a minor and temporary adverse effect.

Heavy Metal Leaching into the Water Column

Potentially, heavy metals could leach into the water column from lead anchors, lead dropper weights (half-coated with cadmium plating), aluminum alloy parachute weights, copper core guidance wire, and/or electronic countermeasure and sonobuoy devices with steel housings used in the course of DBRC operations. These anchors, weights, guidance wires, and devices will all mostly sink into the soft sediments at the bottom of Dabob Bay or Hood Canal. Lead, copper, cadmium, and aluminum can be toxic to many marine organisms in certain forms and at certain concentrations (PSEP 1991). These potential sources of contaminants are very unlikely to significantly affect water quality in Dabob Bay or northern Hood Canal, with the possible exception of lead slowly released from the top of lost diamond-shaped anchor exposed to seawater above the sediment surface.

As more environmentally friendly techniques and substances become technologically feasible and available, the Navy is committed to moving towards the use of new technologies on a routine basis.

Diamond-shaped 6,000-lb (2,700 kg) lead anchors are used for temporary anchoring of tracking and other devices during tests. The top of a lost diamond-shaped lead anchor sunk into the sediments would be subject to seawater corrosion over time. Some of these anchors have been lost in the past, but measures have been implemented to reduce or eliminate these losses. Occurrences of lost anchors are rare (MAKERS 1999). The corrosion rate of lead in seawater ranges from 0.3 to 1.2 mils per year (0.00762 to 0.0305 mm per year), or an average of 0.75 mils per year (0.0019 mm per year) (Kennish 1989). This rate of corrosion acting on a 3,329 square inch (2.15 m^2) anchor top, would lead to a potential loss of 0.46 kg of lead per year per unrecovered anchor unit.

To reach the WDOE acute water quality criterion for lead of 210 µg/L, 0.46 kg of lead would have to be diluted into 2,190,476 liters of water, or 2,190 cubic meters of water. This volume of water would be contained in a half-sphere with a radius of 33.19 feet (10.15 m) centered above the anchor top. Because any lead would be released slowly and continuously into the water over an entire year, it is likely that the small amounts of lead entering the water per hour would be adequately diluted on an ongoing basis, without building up concentrations toxic to marine organisms. While the lead will not be available to organisms in the water column, sediments directly adjacent to the source will probably exceed SMSs.

In addition, up to 40 small 36 lb (16.3 kg) lead "dropper weights" are expected to be jettisoned each year in the course of the MK 46 testing program falling to the bottom and sinking into the sediment. These weights are half-coated with cadmium. There is a program to eventually replace the current lightweight torpedoes with a more advanced torpedo that will not use the lead droppers. Thus over the course of the next 10 years, it is expected that the amount of lead droppers will decline. Small aluminum (6 lb [2.7 kg]) alloy weights are jettisoned from torpedo parachutes in some range tests, along with nylon parachutes (4.3 square yards [3.6 m^2]) and harnesses, about 10 times per year. These weights will also sink into the sediments. Torpedo testing involves the use of insulated copper cored guidance wire trailed behind the torpedo. This guidance wire is then left to sink to the sea bottom after the conclusion of the test. In addition, approximately 50 electronic countermeasure devices (3-5 inches [7.6 to 12.7 cm] in diameter and 2-6 ft [0.6 to 1.2 m] long) will be deployed during DBRC operations each year, which will fall to the bottom and sink into the sediments. These devices have steel housings and contain batteries with heavy metals such as zinc, copper, cadmium, and lead. In addition about 10 acoustic listening devices known as sonobuoys are estimated to be lost each year. These devices with steel housing and the same batteries will also sink into the sediments.

Materials dropped to the bottom are expected to settle into and below the mostly anaerobic surface sediments and completely anaerobic sub-surface sediments at the bottom of Dabob Bay. If materials happen to fall onto the small percentage of the bay bottom with aerobic surface sediments, they will likely settle below the surface and imbed into anaerobic sub-surface sediments. Any leached lead or other heavy metals from these sources will likely be adsorbed onto anaerobic bottom sediments and would not be released into the water column (Song and Muller 1999; PSEP 1991; Cowie and Hedges 1992; D'Itri 1990). Wong et al. (1978) stated that only waterborne, soluble lead is toxic to aquatic biota. Thus, no adverse impacts to water quality from heavy metals would result from anchors, weights, guidance wire, and other devices.

The recent study conducted by the Battelle Marine Sciences Laboratory indicated that water quality samples taken at four stations along the axis of the Dabob Bay test range at 1 meter below the surface and 10 meters above the bottom did not contain elevated levels of cadmium, copper, lead or zinc (Crecelius 2001). Water quality samples taken 10 meters above the bottom would reflect metal concentrations leached out into the water column from metal objects on the bay bottom, if this process was occurring to any significant degree. Analysis of the seawater samples indicated that heavy metal analytes were present at low levels comparable to background levels present in non-urban portions of Puget Sound. The four metals (Cd, Cu, Pb, and Zn) had concentrations well below listed Washington State water quality criteria.

3.1.2.2 Dabob Bay Limited Alternative

Environmental impacts would be the same as for the Preferred Alternative, with the difference that they would be geographically concentrated within the Dabob Bay MOA. No range testing or proofing operations would occur in

Hood Canal under this alternative based on the OMP or this assessment. The tests that would be shifted from Hood Canal to Dabob Bay would add a minor, incremental amount of lead, cadmium, and aluminum from test vehicle weights. The effects would be negligible above those described for the Preferred Alternative.

3.1.2.3 No Action Alternative

Environmental impacts would be similar in type as for the Preferred Alternative. Environmental impacts of tests would need to be established by individual testing programs with NUWC Division Keyport. Quantity and type of tests may vary widely from events described in the Preferred Alternative, as impacts would depend on test program parameters established for each independent program.

3.1.3 Mitigation Measures

No significant impacts are anticipated to water quality. This is confirmed by the results of the Battelle Marine Sciences Laboratory study, which found that the metal analytes listed above were present at low levels in seawater comparable to background levels present in non-urban portions of Puget Sound. Standards for turbidity may be temporarily exceeded while excavating torpedoes from bottom sediments on rare occasions. This is based upon the analysis of operations and their potential consequences against the Clean Water Act standards. Therefore, no mitigation measures are proposed or required.

3.2 MARINE SEDIMENTS

This section reviews operations in relation to the Clean Water Act. This section addresses sediment quality and composition in Dabob Bay and Hood Canal and indicates that DBRC operations are in compliance for each of these areas.

3.2.1 Affected Environment

3.2.1.1 Sediment Composition

Sources of sediments in Puget Sound include rivers, shoreline erosion, biogenic deposits, and possible submarine sources (Perillo and Lavelle 1989). Coastal sediments receive carbon from terrestrial and marine sources, and the ratios of sediments derived from these two sources exhibit spatial and seasonal variability (Furlong and Carpenter 1988). The composition of the marine sediments varies, but the seafloor in the study area is typically of the soft bottom type.

Unlike many fjords with shallow sills, the bottom waters on Hood Canal and the Dabob Bay region generally do not become anaerobic and there is enough oxygen in surface sediments and pore waters to sustain healthy benthic populations (Christensen 1974; Paulson et al. 1993). In certain areas, however, fine sediments, high organic content, poor water circulation, a limited availability of oxygen, and increased microbial metabolism may contribute to sediments becoming hypoxic (i.e., without oxygen) (Ebbesmeyer 1973). At one station in northern Dabob Bay, north of the DBRC test range, only the top few centimeters of surface sediments in Dabob Bay were found to be oxidized, while all sediments below the top few centimeters were anaerobic (Cowie and Hedges 1992).

A recent study conducted by the Battelle Marine Sciences Laboratory found that at 13 out of 14 stations sampled along the axis of the DBRC test range in Dabob Bay, acid volatile sulfide (AVS) concentrations indicated that the majority of the surface sediments at the bottom of the bay were anaerobic (see Table 6 in Crecelius, 2001).

Dabob Bay

Within Dabob Bay, bottom sediments consist primarily of silt and clay, with silt accounting for around 40 percent of the bottom material, clay around 57 percent, and sand accounting for the remaining 3 percent (Roberts 1974). No sediments in the gravel size range are present. The bulk of Dabob Bay sediments are classified as sandy-mud with a sand to mud ratio between 1:1 and 1:9. Bulk sediment accumulation rates indicate that surface sediments accumulate at the rate of 850 to 1,400 g/m^2/year for a site at the head of Dabob Bay (Furlong and Carpenter 1988; Carpenter et al. 1985).

The results of the Battelle Marine Sciences Laboratory study confirmed this general pattern of sediment grain-size composition at 13 out of 14 stations sampled (see Table 4 in Crecelius, 2001). For these stations, sediments in the silts category ranged from 34 to 49%, and clays ranged from 49 to 65% of the sediments, with sands ranging from 0.2 to 2% and gravels ranging from 0 to 0.12%. Crecelius (2001) states that sediments with these grain-size attributes are typical of those in deep quiet bays in Puget Sound. The one exception to this pattern were the sediments at Station 3, which had a higher percentage of silts (58%), lower clays (15%), and higher sands (21%) and gravels (6%). This station also had much lower AVS content, lower total organic carbon (TOC) and higher percent solids. Crecelius (2001) also stated that hard clumps of gray clays were found at this station and attributed the differing sediment composition to the results of an underwater landslide or other disturbance.

Hood Canal

Data in Roberts (1974), a station in Hood Canal located mid-channel around 2 nm (3.7 km) north of Bangor had sediment composition breakdown of 0.36 percent gravel, 85.23 percent sand, 8.65 percent silt, and 5.76 percent clay. At stations farther north in the vicinity of South Point, the mean breakdown is as follows: 2 percent gravel, 55 percent sand, 37 percent silt, and 6 percent clay.

Hood Canal sediments are classified as muddy-sand with a sand to mud ratio between 1:1 and 9:1. Sediments in Hood Canal have somewhat larger grain sizes than those in Dabob Bay, with sand more prominent than mud. Sediment fluxes between the mouth of Dabob Bay and the main passage of Hood Canal are likely to be minimal due to weak horizontal advective transport forces (current movements that carry sediments) within the bay and surrounding areas.

3.2.1.2 Sediment Quality and Chemistry

Dabob Bay

Data from 23 sediment quality stations were obtained for Dabob Bay from the Sediment Quality Information System (SEDQUAL) database developed by the WDOE (Figure 3.1-2) (WDOE 1999). One of these stations is the Puget Sound Ambient Monitoring Program (PSAMP) Station 15, monitored by WDOE, near Zelatched Point. Data from these stations were collected at various times from 1972 to the present and included sediment chemistry data for metals, high and low molecular weight hydrocarbons, phenolics, acids, alcohols, and other chemicals. Sediment quality standards (SQS) criteria for many of these chemicals are listed in the Sediment Management Standards (SMS) for the State of Washington (Chapter 173-204 WAC) (WDOE 1995). Exceedances of these criteria in marine sediments represent a potential risk to marine organisms exposed to the sediments.

Many of the SMS SQS criteria for organic compounds are expressed as concentrations normalized to the Total Organic Carbon (TOC) content of the sampled sediments. Comparison of the sediment chemistry data to the SMS criteria requires the normalization of the data to TOC content. Sediments at some stations in the project area, including PSAMP Stations 14 and 15, have been found to have very low TOC content (< 0.1 percent). For sediments with very low TOC, it may be inappropriate to use the SMS criteria, and is more appropriate to use Apparent Effects Threshold (AET) criteria expressed as dry weight concentrations, not as concentrations normalized to TOC (Michelsen 1992). The Dredged Material Management Program (DMMP) Screening Level (SL) criteria fit this description (U.S. Army Corps of Engineers [USACOE] 1998).

Organic carbon normalized sediment chemistry data (for detected analytes) from the 23 Dabob Bay stations were compared to SMS SQS criteria. This comparison resulted in criteria exceedances only at PSAMP Station 15, for various polycyclic aromatic hydrocarbons (PAHs) in each of five years from 1989 to 1993. WDOE did not sample sediments at this station after 1993. However, comparison of these data to SMS SQS criteria may be inappropriate in this case, as the sediment TOC percentages were below 0.1 percent at this station. When data from PSAMP Station 15 are compared to DMMP SL criteria, no analytes exceeded criteria.

The Navy recently commissioned the Battelle Marine Sciences Laboratory (MSL) to conduct a field study to document current water and sediment quality conditions at the DBRC test range in Dabob Bay, and to assess potential impacts to water and sediment quality from decades of Navy use of the test range (Crecelius 2001). A copy of the study report is found in Appendix D.

In January of 2001, the Battelle MSL collected sediment and water samples in Dabob Bay on the DBRC test range. Surface sediment samples were collected at 14 stations on the bottom of Dabob Bay along the main axis of the DBRC test range (Figure 1 in Crecelius, 2001). Seawater samples were also collected at four of these stations at 1 meter below the surface and 10 meters above the bottom. The sediment and seawater samples were analyzed for cadmium (Cd), copper (Cu), lithium (Li), lead (Pb), zinc (Zn) and zirconium (Zr), elements identified as being present in torpedo exhaust, and /or anchor and dropper weights and other debris generated by operations at the DBRC. The sediment samples were also analyzed for acid-volatile sulfides (AVS) and simultaneously extracted metals (SEM), total organic carbon (TOC), and grain size.

Laboratory analysis results for the sediment samples indicated that the metal analytes were present at low levels consistent with levels found in other muddy, non-urban bays in Puget Sound (see Tables 6 and 8 in Crecelius, 2001). Concentrations of the four metals (Cd, Cu, Pb, and Zn) with listed Washington State Sediment Quality Standards (SQS) criteria, were well below these criteria. The other two metals (Li and Zr) do not have SQS criteria, but the concentrations seen were considered typical of naturally occurring sedimentary rock.

Hood Canal

Data from the SEDQUAL database were obtained for two stations in the Hood Canal MOA—PSAMP Station 14, located 2 nm (3.7 km) north of Bangor Marginal Wharf at mid-channel, and Station TRF-01MC adjacent to Bangor Marginal Wharf (Figure 3.1-2). Organic carbon normalized sediment chemistry data (for detected analytes) from these stations were also compared to SMS SQS criteria. This comparison resulted in criteria exceedances only at PSAMP Station 14, also for PAHs in each of the six years sampled (1989-93 and 1995). TOC content at Station 14 was also below 0.1 percent, and comparison of these data to the DMMP SL chemical criteria showed no exceedances.

Under Section 303(d) of the federal Clean Water Act, the WDOE Impaired and Threatened Surface Waters report for 1998 placed Hood Canal north region WA-PS-0100 on the list for 20 violations of SMS sediment screening cleanup levels for samples collected at a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Superfund site near SUBASE Bangor (WDOE 1998). However, the source of sediment contaminants at the Bangor CERCLA site is unrelated to present or past operations of the Dabob Bay and Hood Canal MOAs. The Bangor site was used as a munitions loading area during World War II, which is the likely source of contaminants that contributed to the SMS cleanup level criteria.

3.2.2 Environmental Consequences

Potential effects on sediments of ongoing and future operations of the Dabob Bay and Hood Canal MOAs are related to: (1) seabed disturbance, and (2) heavy metal leaching, as discussed below.

3.2.2.1 Preferred Alternative

Seabed Disturbance

Temporary increases in water column turbidity arising from seabed disturbance can occur during the retrieval of torpedoes and other devices from the sea bottom as part of range operations. Retrievals of torpedoes or other devices from the sea bottom are infrequent, occurring less than 14 times per year (MAKERS 1999). In about half of these retrievals (or about 7 times a year), torpedoes may embed themselves in the soft bottom sediments, requiring that they be washed out using pressure-washing systems to clear away mud. The majority of embedded torpedo recoveries would disturb the surface of the seabed within a circular area with an approximate radius of 15 feet (4.6 m), or 707 square feet (66 m^2). Within this area, a volume of sediments would be disturbed approximating a hemisphere in shape, with a 15-foot (4.6-m) radius, or 524 cubic yards (400 m^3) of sediment. Torpedoes have rarely been known to bury themselves as deep as 28 feet (8.5 m) measured to the tail, although this represents the extreme, happening approximately once every five years.

The sediments disturbed during these recovery operations would quickly settle back to the bottom. Observations of torpedo recoveries in Dabob Bay indicate that it takes approximately 2 hours for disturbed sediment to completely settle to the bottom. This is consistent with Bowen (1976), in a computer modeling study of dredged material disposal, who estimated that 77 percent of a 310 cubic yard (237 m^3) volume of sediments dropped in 50 feet (15.2 m) of water would settle to the bottom within 25 minutes. Similar settlement volume percentages were obtained ranging from 82 to 78 percent for sediment volumes from 4.9 to 2,479 cubic yards (3.7 to 1,895 m^3).

Heavy Metal Leaching into Sediments

Potentially, heavy metals could leach into sediments from lead anchors, lead dropper weights (half-coated with cadmium plating), aluminum alloy parachute weights, copper core guidance wire and/or electronic countermeasure and sonobuoy devices with steel housings used in the course of DBRC operations. These anchors, weights, guidance wires, and devices will all mostly sink into the soft sediments at the bottom of Dabob Bay or Hood Canal.

On January 20, 2000, an underwater video inspection of the Dabob Bay seafloor in the range was conducted with a Remotely Operated Vehicle (ROV). Two 1,000-yard (910 m) transect lines perpendicular to the range centerline were inspected: (1) a transect line located at the 5,500-yard (5,005 m) station along the centerline was inspected from 500 yards (455 m) east to 500 yards west of the centerline in water ranging from 606 feet (185 m) to 390 feet (119 m) deep (northeast of Pulali Point); and (2) a transect line located at the 10,500-yard (9,555 m) station along the centerline was inspected from 500 yards (455 m) west to 500 yards east of the centerline in water ranging from 528 feet (161 m) to 492 feet (150 m) deep (southwest of Zelatched Point; water depths from NOAA 1997).

In the video footage of the first transect line, no man-made objects used in range operations (such as anchors, weights, or guidance wire) were visible. The only unusual objects visible were one wooden piling or log and a portion of a frame-like structure, covered by fouling organisms. The footage showed soft sediments with small depressions visible (most likely bivalve siphon holes) and occasional flatfish and bottom fish. The video footage of the second transect line also showed soft sediments with small depressions and the same types of fish. No man-made or unusual objects were visible in the footage.

Surface sediment samples collected by the Battelle MSL on the bottom of Dabob Bay on the DBRC test range indicate that analyzed metals (Cd, Cu, Pb, Zn, Li, and Zr) are not present at elevated levels (Crecelius 2001). Metal concentrations observed are at low levels comparable to background levels present in other muddy, non-urban bays in Puget Sound. These concentrations are either well below Washington State sediment quality standards (Cd, Cu, Pb and Zn) or are at naturally occurring levels seen in sedimentary rock (Li and Zr).

Lead, copper, cadmium, and aluminum can be toxic to many marine organisms in certain forms and at certain concentrations (PSEP 1991). There are no federal EPA sediment quality criteria for the protection of aquatic life for lead or copper. The WDOE SMS SQS criteria for lead and copper are 450 mg/kg (dry weight) and 390 mg/kg respectively (Chapter 173-204 WAC). The SMS SQS criterion for cadmium is 5.1 mg/kg (dryweight). There are no sediment quality criteria for aluminum or for iron, the primary element in steel, which are relatively non-toxic (Baudo 1990; Continental Shelf Associates 1997).

Diamond-shaped 6,000-lb (2,700 kg) lead anchors are used for temporary anchoring of craft during tests. Some of these anchors have been lost in the past, but measures have been implemented to minimize these losses (MAKERS 1999). In addition, up to 40 small 36 lb (16.3 kg) lead “dropper weights” are expected to be jettisoned each year in the course of the MK 46 testing program. These weights are half-coated with cadmium. There is a program to eventually replace the current lightweight torpedoes with a more advanced torpedo which will not use the lead droppers. Thus over the course of the next 10 years it is expected that the amount of lead droppers will decline. Small (6-lb [2.7 kg]) aluminum alloy weights are jettisoned from torpedo parachutes in some range tests, along with nylon parachutes (4.3 sq yrds [3.6 m^2]) and harnesses, about 10 times per year. Torpedo testing also involves the use of insulated copper cored guidance wire trailed behind the torpedo. This guidance wire is then left to sink to the sea bottom after the conclusion of the test. In addition, approximately 50 electronic countermeasure devices (3-5 inches [7.6 to 12.7 cm] in diameter and 2-6 ft [0.6 to 1.2 m] long) will be deployed during DBRC operations each year, which will fall to the bottom and sink into the sediments. These devices have steel housings and contain batteries with heavy metals such as zinc, copper, cadmium, and lead. In addition about 10 acoustic listening devices known as sonobuoys are estimated to be lost each year. These devices with steel housing and the same batteries will also sink into the sediments.

These potential sources of contaminants are very unlikely to significantly affect sediment quality in Dabob Bay or northern Hood Canal. The vast amount of heavy metals in objects lost to the sea floor will remain unexposed to the environment inside the mass of the metal objects. Any leaching of heavy metals into sediments would be limited to: (1) small quantities of lead released during temporary diamond-shaped anchor use on the scale of days to weeks; (2) small quantities of lead, cadmium, aluminum, and iron from limited use of lightweight torpedo lead dropper weights, electronic countermeasure and sonobuoy devices, aluminum alloy parachute weights, or from a lost anchor unit sunk on the bottom; (3) very small quantities of copper exposed on wire ends only, as the wires used are insulated with a polyethylene coating; and (4) small quantities of zinc, copper, cadmium, and lead in device batteries, if exposed via corrosion of steel housings. Polyethylene is an insoluble, non-corrosive, non-biodegradable polymer, which performs best in high pressure, low temperature dark environments such as the ocean bottom (Czagas 1998; Van der Zee et al. 1994). Materials dropped to the bottom are expected to settle into and below the mostly anaerobic surface sediments and completely anaerobic sub-surface sediments at the bottom of Dabob Bay. If materials happen to fall onto the small percentage of the bay bottom with aerobic surface sediments, they will likely settle below the surface and imbed into anaerobic sub-surface sediments.

Any leached lead and other heavy metals from these sources are likely to be adsorbed onto anaerobic bottom sediments (present at the surface in most areas and below the upper few (1-2) cm of sediment) and would not be released to pore water (water between sediment grains) (Song and Muller 1999; PSEP 1991; and D'Itri 1990). The heavy metals cadmium, copper, nickel, lead, and zinc are bound to acid-volatile sulfides in anaerobic sediments, and are not bio-available to marine organisms dwelling in the sediments (Ankley et al. 1996). These heavy metals are potentially bio-available to marine organisms dwelling in those few areas with aerobic surface sediments present in the upper few (1-2) cm at the bottom of Dabob Bay (Cowie and Hedges 1992). There is evidence that lead exposed to anaerobic sediments forms an insoluble sulfide layer, inhibiting further release of lead to the environment (RMC and UBC 1996). D'Itri (1990) stated that lead forms compounds of low solubility in the sediments with major anions (negatively charged ions), and has little effect on the aquatic environment. Wong et al. (1978) stated that only waterborne, soluble lead is toxic to aquatic biota.

The AVS concentration levels observed in the Crecelius (2001) study (see Crecelius, Table 6) indicate that surface sediments (0-2 cm) on the bottom of Dabob Bay along the length of the DBRC test range are anaerobic at 13 of the 14 stations sampled, with the exception of sediments at Station 3, where AVS was not detected at the laboratory detection limit (Chapman et al. 1998). Station 3 also had distinctly different sediment composition characteristics as noted above, with higher percentages of larger grained sediments, higher percent solids and lower TOC than the other 13 stations sampled.

In anaerobic sediments where the ratio of simultaneously extracted metals (SEM) to AVS is < 1.0, cationic metals such as Cd, Cu, Pb, Zn, and nickel (Ni) are rendered non-toxic via the formation of sulfide compounds which are not bio-available to benthic organisms (Ankley et al., 1996). The SEM / AVS ratio is < 1.0 for all relevant metals analyzed (Cd, Cu, Pb, and Zn) at all of the Dabob Bay stations sampled, with the exception of Station 3. Therefore the AVS content of almost all surface (0 to 2 cm) and subsurface (deeper than 2 cm) sediments at the bottom of Dabob Bay into which dropper weights, anchor weights and other metal debris generated by DBRC operations fall, will render the surface of the metal objects and any small amount of leached metals non-toxic to benthic organisms. As a result of AVS binding, no metals will be released into the sediment pore water, and thus the water column, under these sediment conditions. This is confirmed by the low levels of heavy metals found in water samples collected by Battelle 10 meters off the bottom (Crecelius 2001).

Lithium (Li) and zirconium (Zr) are not present in the metal objects jettisoned to the bay bottom during the course of range operations. They were analyzed in surface sediments as they are present in torpedo exhaust, and were found to be present at naturally occurring levels for sedimentary rock (Crecelius 2001). The SEM / AVS ratio analysis approach is not applicable to the metals Li and Zr.

In those few areas of the bay bottom with aerobic surface sediments similar to those observed at Station 3, the metal weights and other objects will likely sink into subsurface sediments deeper than 2 cm, where anaerobic conditions exist even below aerobic surface sediments, with the same effect. However, it is possible that small amounts of metal could leach into the sediment and associated pore water in toxic forms in the small percentage of the bottom of the DBRC test range which supports aerobic surface sediments, if the metal objects remain at the surface after being jettisoned. However, even in aerobic surface sediments, other components of the sediment can serve to bind heavy metals in ways similar to AVS (Chapman et al. 1998).

Thus, the small lead dropper weights (4 inches [10.2 cm] high by 8 inches [20.3 cm] wide), most likely buried in the sediments when jettisoned, would not lose significant amounts of lead to the sediments. This would also be true for most of the surface area of the large diamond-shaped lead anchors. The wire ends of copper guidance wire sunk into the sediments would also not lose significant amounts of copper. As stated above, the small dropper weights would most likely sink into the soft sediments on the bottom of Dabob Bay or Hood Canal. If any of the cadmium plating half-coating the small dropper weights were to leach off the weights, it would most likely be absorbed onto clay particles present in the sediments (PSEP 1991) and /or be bound to acid-volatile sulfides in anaerobic sediments present at the surface in most areas below the upper few (1-2) cm. The aluminum alloy parachute weights jettisoned from about 10 tests per year would also sink into the soft sediments on the seafloor. Some aluminum alloys are nearly completely resistant to seawater corrosion, while most have high resistance (Kennish 1989). As aluminum is relatively non-toxic, resistant to corrosion and the jettisoned weights are small and few in number, no significant effects on sediment quality in Dabob Bay and Hood Canal are expected. In addition to the above any unrecovered anchors and guidance wire not completely sunk into the soft-bottom sediments in deep water would also be subject to sedimentation processes over time. Sediments are estimated to accumulate on the bottom of Dabob Bay at a rate of 0.027 to 0.044 inches per year (0.068 to 0.112 cm per year), and at rate of 0.082 to 0.378 inches per year (0.208 to 0.96 cm per year) in northern Hood Canal (calculated from Furlong and Carpenter [1988]; Carpenter et al. [1985] and WDOE [1991]). Thus, any weights or guidance wire not completely sunk into the anaerobic sediments will eventually be completely buried in sediment and not available to adversely affect marine organisms. Biological activity is typically restricted to the top 3.9 inches (10 cm) of the sediments although only the upper few (1-2) cm are oxidized in a small percentage at the bottom of Dabob Bay (WDOE 1991; Copping et al. 1989). Objects deeper than this are only accessible to the deepest-burrowing organisms.

All of the above factors would reduce or eliminate the possibility of: (1) significant sediment contamination from lead and copper in lost anchors, guidance wire, and other devices; and (2) that lead and copper would be bio-available (in a form that can be used or can affect) to marine organisms dwelling in the sediments. Marine organisms dwelling in the upper few (1-2) cm of sediments which are aerobic immediately adjacent to the lost objects may be adversely affected (reduced in numbers) by heavy metals which are bio-available in this zone. This would be a highly localized effect, which would not be significant at a population level scale. However, only a small percentage of surface sediments on the bottom of Dabob Bay are aerobic.

The fact that sediment samples taken in Dabob Bay and northern Hood Canal (with the exception of samples taken at the Bangor Superfund site) do not show elevated levels of lead, copper, or other compounds above sediment quality criteria indicates that past DBRC operations have not significantly contributed significant levels of contaminants to the sediments at those locations. This was confirmed by the results of the recent Battelle Marine Sciences Laboratory study where metal (Cd, Cu, Pb, Zn, Li, Zr) concentrations were found in surface sediment samples taken along the axis of the DBRC test range at low levels (see Tables 6 and 8 in Crecelius, 2001). These concentrations were well below Washington State Sediment Quality Standards criteria and are comparable to background levels seen in other muddy bays in non-urban portions of Puget Sound (see Tables 6 and 8 in Crecelius, 2001). While sediment directly adjacent to dropped lead may exceed sediment standards, this is a minor and localized event. Thus, ongoing and future operations of the DBRC are also unlikely to contribute significant levels of contaminants to the sediments in Dabob Bay and northern Hood Canal.

3.2.2.2 Dabob Bay Limited Alternative

Environmental impacts would be the same as for the Preferred Alternative, with the difference that they would be geographically concentrated within the Dabob Bay MOA. As most tests that result in seabed disturbance or release of copper guidewires currently occur in Dabob Bay, the alternative differences would be minimal. No range testing or proofing operations would occur in Hood Canal under this alternative. Testing that would shift from Hood Canal to Dabob Bay would have negligible effects above those described under the Preferred Alternative.

3.2.2.3 No Action Alternative

Environmental impacts would be similar in type as for the Preferred Alternative. Environmental impacts of tests would need to be established by individual testing programs with NUWC Division Keyport. Quantity and type of tests may vary widely from events described in the Preferred Alternative, as impacts would depend on test program parameters established for each independent program.

3.2.3 Mitigation Measures

No significant impacts are anticipated to sediment standards. Therefore, no mitigation measures are proposed or required. There may be minor localized exceedances of sediment standards from discharged or lost lead weights or anchors in the immediate vicinity of these materials. Because there are no significant effects to sediment in the DBRC no mitigation measures are required or proposed.

3.3 AIR QUALITY

This section reviews operations in relation to the Clean Air Act. This section addresses air quality issues in Dabob Bay and Hood Canal. The analysis presented below shows that the Navy is in compliance with local and federal regulations for each of these areas.

3.3.1 Affected Environment

This section describes the air quality in the vicinity of the DBRC including all of Dabob Bay, Hood Canal from Dosewallips State Park to Bridgehaven, and transport routes. The region of influence would be the geographic airshed and would include counties controlled by both the Olympic Air Pollution Control Authority (Jefferson County) and the Puget Sound Clean Air Agency (Kitsap County). The County line is the dividing line for these authorities. The DBRC is in attainment for all pollutants in both Kitsap and Jefferson County. Therefore, a Conformity Determination for the effects of the project to air quality standards is not necessary for the project.

Air quality in the region is a function of the size and topography of the area, the meteorology and climate, and the prevalence of air pollutants. In the DBRC, the mountainous terrain, marine climate, and prevailing winds all play an important role in maintaining healthy air quality. The region is in attainment for all pollutants, but due to its potential for impact in more urbanized areas, Kitsap County has stricter controls for ozone precursors than would otherwise be the case. While Kitsap County had high levels of carbon monoxide several years ago, it has always been, and continues to be, in attainment. Both ozone and particulate matter are present at levels that may periodically approach the permitted concentration limits. As such, the primary pollutants of concern in the region are ozone (and its precursors) and particulate matter (specifically that particulate matter with an average aerodynamic diameter of 10 micrometers or less [PM-10]). Traffic around Hood Canal is prone to periodic congestion and may cause temporary elevations in carbon monoxide concentrations. However, steps taken to control carbon monoxide emissions have been largely successful and there have been no exceedances of the state or federal standards in more than seven years. As such, carbon monoxide is generally of less concern than either ozone or PM-10.

Historically, primary sources of PM-10 pollution have been open burning and the use of woodstoves and fireplaces. Open burning is now prohibited in urban areas and requires a permit in rural areas. The majority of the homes in the area still burn wood as a secondary heating source and some still use it as the primary source. Older wood stoves and fireplaces tend to emit high levels of PM-10, and the local agencies are taking steps to encourage homeowners to switch to cleaner heating sources. Measures such as the prohibition of open burning in populated areas and institution of burn bans have succeeded in lowering ambient levels of PM-10 pollution. The entire state is currently considered to be in attainment for PM-10.

Direct emissions of ozone are minimal in the area, and ambient ozone levels are due primarily to secondary sources. Sunlight acts on precursor pollutants and drives the generation of additional ozone. Precursor pollutants include oxides of nitrogen and sulfur, and volatile organic compounds (VOCs). Nitrogen oxides originate primarily in vehicle exhaust, while sulfur oxide pollution is generally attributed to industrial sources. Ambient ozone levels are generally higher in the summer, both because there is more sunlight and because of increased emission levels. Both Jefferson County and Kitsap County are in attainment for ozone. While Kitsap County is not specifically included in the Puget Sound ozone maintenance area, the Puget Sound Clean Air Agency still includes emissions limitations on VOCs to limit secondary ozone in other areas.

Vehicle exhaust is also a primary source for carbon monoxide pollution. Both areas are in attainment for the federal and state carbon monoxide standards. As noted previously, traffic congestion may cause intermittent elevations in carbon monoxide concentrations, but there have been no violations of federal or state health standards in over seven years.

Both population densities and the number of industries in the area are low, with a correspondingly low number of major pollution sources. Major pollution sources are required to maintain permits limiting the permissible emissions to maintain healthy air quality. Major source permits, Title V Air Permits, are issued by the local air pollution authority or agency in accordance with federal and state law. There are no major pollution sources in the immediate vicinity of the DBRC. Traffic in the area is concentrated primarily around the Hood Canal.

3.3.2 Environmental Consequences

Activities associated with the Proposed Action have been ongoing at varying levels of intensity since 1954. The majority of emissions are generated by mobile sources (surface vessels, transport to and from the shore facilities, and aircraft and helicopters), with the only stationary sources being the support operations at NUWC Division Keyport and SUBASE Bangor and the operation and maintenance of the range control facilities at Zelatched Point. The following section presents the potential impacts of these in greater detail.

3.3.2.1 Preferred Alternative

Potential air quality impacts due to support operations at both NUWC Division Keyport and SUBASE Bangor are incorporated in the base permits and inventories and are not addressed in this analysis. Zelatched Point is physically removed from NUWC Division Keyport SUBASE Bangor and serves as a Range Control site. The pier at Zelatched Point serves as temporary mooring during operations. The pier is unpowered, and the range control station is served by commercial power with backup generating capability. There are typically no air pollutant emissions sources at Zelatched Point other than periodic maintenance activities (painting, cleaning, etc.). The emissions due to maintenance and operations at Zelatched Point are negligible and have minimal impact on air quality.

The main type of activity in the DBRC involves testing, primarily underwater vehicles. Neither the launch nor the testing of these underwater vehicle systems results in an air quality impact. The systems are launched with either compressed air or pressurized water and air, and would have no impact on air quality. The analysis of exhausts in the water quality section (Section 3.1) indicates that some dissolved gasses would remain in the water column, depending on the depth of the test vehicle and the specific chemical components. The quantity of gases that reach the water surface and disperse in the air are negligible. In addition, exhaust gases that would reach the atmosphere are dispersed over the length of the test run, ensuring further dispersion of the exhaust gas. There would be only negligible effects to air quality from test vehicle exhaust gasses.

Due to the intermittent nature of the emissions and low levels of emissions during any given operation, it is anticipated that continuing operations at the DBRC would cause no additional environmental consequences to air quality.

Ground transport is limited to two main activities. The majority of ground transport involves travel between Keyport and the Keyport/Bangor Dock where the exercise craft are moored. The roundtrip distance is less than 10 miles (16 km). Due to the variety of the operations formats, daily travel levels vary. On average, about 4 vehicles are involved for any particular event, for a total of less than 40 vehicle miles traveled per day between Keyport and the Keyport/Bangor Dock. In addition, the Range Control Site at Zelatched Point is staffed on a regular basis (less than five vehicle trips per day). Zelatched Point is approximately 32 miles (51 km) from Keyport by road, for a roundtrip total of approximately 64 miles (105 km). Ground transport between Keyport and NASWI is limited to 60 trips or less (based on less than 30 air operations) per year. The distance between Keyport and NASWI is about 57 miles (91.7 km) one-way. These trips would be negligible as a fraction of the total trips on the roads.

Puget Sound is currently a maintenance area for ozone. Therefore, federal activities there are subject to Conformity Determination requirements of the Clean Air Act (40 CFR part 93 and 40 CFR Part 51 Subpart W). These regulations require all federal agencies to comply with approved federal or state implementation plans. Dabob Bay is not located in the current maintenance area and none of the current activities are subject to conformity analysis. Any activity that is expanded in such a way as to take place (in part or in whole) within the maintenance area would be required to conduct a conformity determination analysis. No such expansion of activity is currently scheduled for NUWC Division Keyport's testing and proofing operations in Dabob Bay/Hood Canal.

The level of activity described in the Proposed Action can be incorporated in the region's air emissions planning with no detrimental impacts.

Watercraft used in the proposed operations include both surface vessels and submarines. Submarines are usually nuclear-powered and pose no air quality risk under normal operations. Surface craft in the DBRC are generally powered by diesel and gasoline motors and would be the primary source of pollutants during operations in the DBRC. Only a limited number of vessels are active in the DBRC at any one time. The limited number of vessels serves to ensure the proposed operations have a minimal impact to air quality in the DBRC.

Aircraft are involved in operations in the DBRC less than 30 times per year, with both helicopters and fixed-wing aircraft involved in range activities. When used, typically only one aircraft or helicopter is active in the range at any one point in time. The aircraft are only in the range area for a limited time, and during this time they are generally operating at altitude. These flights would originate and end outside of the affected environment area. As a result, the majority of the aircraft emissions within the project area would occur at altitudes above which any measurable effect on ambient air quality would occur. The infrequent use of aircraft, the brevity of each operation, and the operating altitude all support the conclusion that air operations do not impact the ambient air quality in the DBRC. In addition, given the large volume of air and limited emissions, no long-term effects to regional or local air quality would be anticipated.

Limited use of SF6 oxidant is a potential concern because this oxidant is a contributor to global warming and targeted for reduction by the Kyoto Protocols. For SF6 to be released, rupture of both the outer and inner protective torpedo casings would have to occur, an event which occurs at a rate of once every 10 years. The Navy is currently seeking a replacement of SF6 for use in test vehicles. The limited use of this material and the safety precautions inherent in the test vehicle design (closed system) ensure that it is highly unlikely that SF6 would be released into the atmosphere. No impacts would occur from the minor amount of testing that will be conducted until a substitute material can be found.

In the unlikely event of a complete rupture of a MK 50 torpedo, it is possible that up to 10 lbs (4.5 kilograms) of sulfur hexafluoride could be released to the atmosphere (MAKERS 1999). Typically, an impact rupture would occur at some depth, slowing or reducing the release of SF6 into the atmosphere. The EPA considers sulfur hexafluoride to be a Hazardous Air Pollutant. Potential impacts due to the accidental release of the 10 lbs (4.5 kilograms) of sulfur hexafluoride were analyzed using the EPA-approved screening model TSCREEN. TSCREEN is a suite of dispersion models designed to provide conservative concentration estimates of chemical releases over a spectrum of possible scenarios. Results of the modeling are discussed below.

The scenario used for this analysis assumed the entire contents of one MK 50 torpedo was released into the atmosphere over less than 15 seconds. This would result in the largest concentration of sulfur hexafluoride possible from the rupture of a single torpedo. The Occupation Safety and Health Administration (OSHA) has established a permissible exposure limit of 1,000 ppm (5,970 mg/m^3) averaged over an 8-hour period. The results of the screening indicated that the maximum hourly concentration would be approximately 16 ppm (94 mg/m^3), or less than 1 percent of the workplace exposure standard imposed by OSHA. Screening using EPA-approved modeling found no potential for hazard to the public or operations personnel due to toxicity of sulfur hexafluoride.

3.3.2.2 Dabob Bay Limited Alternative

Environmental impacts would be similar as for the Preferred Alternative. Choice of this alternative would require a shift of all testing and proofing activities to the Dabob Bay MOA, as no range testing or proofing operations would occur in Hood Canal under this alternative. This would require approximately 20 additional round trips per year to Dabob Bay by a YTT or other launching craft. Each additional trip would require about 2 hours, with a commensurate increase in release of diesel combustion byproducts to the air.

3.3.2.3 No Action Alternative

Environmental impacts would be similar in type as for the Preferred Alternative. Environmental impacts of tests would need to be established by individual testing programs with NUWC Division Keyport. Quantity and type of tests may vary widely from events described in the Preferred Alternative, as impacts would depend on test program parameters established for each independent program.

3.3.3 Mitigation Measures

No significant impacts, as measured against the Clean Air Act standards and local regulations, are anticipated to air quality. This is based upon the analysis of operations and their potential consequences against the Clean Air Act standards. Therefore, no mitigation measures are proposed or required.

3.4 MARINE FLORA AND FAUNA

This section reviews operations in relation to the Marine Mammal Protection Act and the Endangered Species Act. This section describes the types of marine vegetation, fish, invertebrae, and marine mammals in Dabob Bay and Hood Canal. Noise impacts are discussed separately in Section 3.7.

3.4.1 Affected Environment

3.4.1.1 Marine Flora

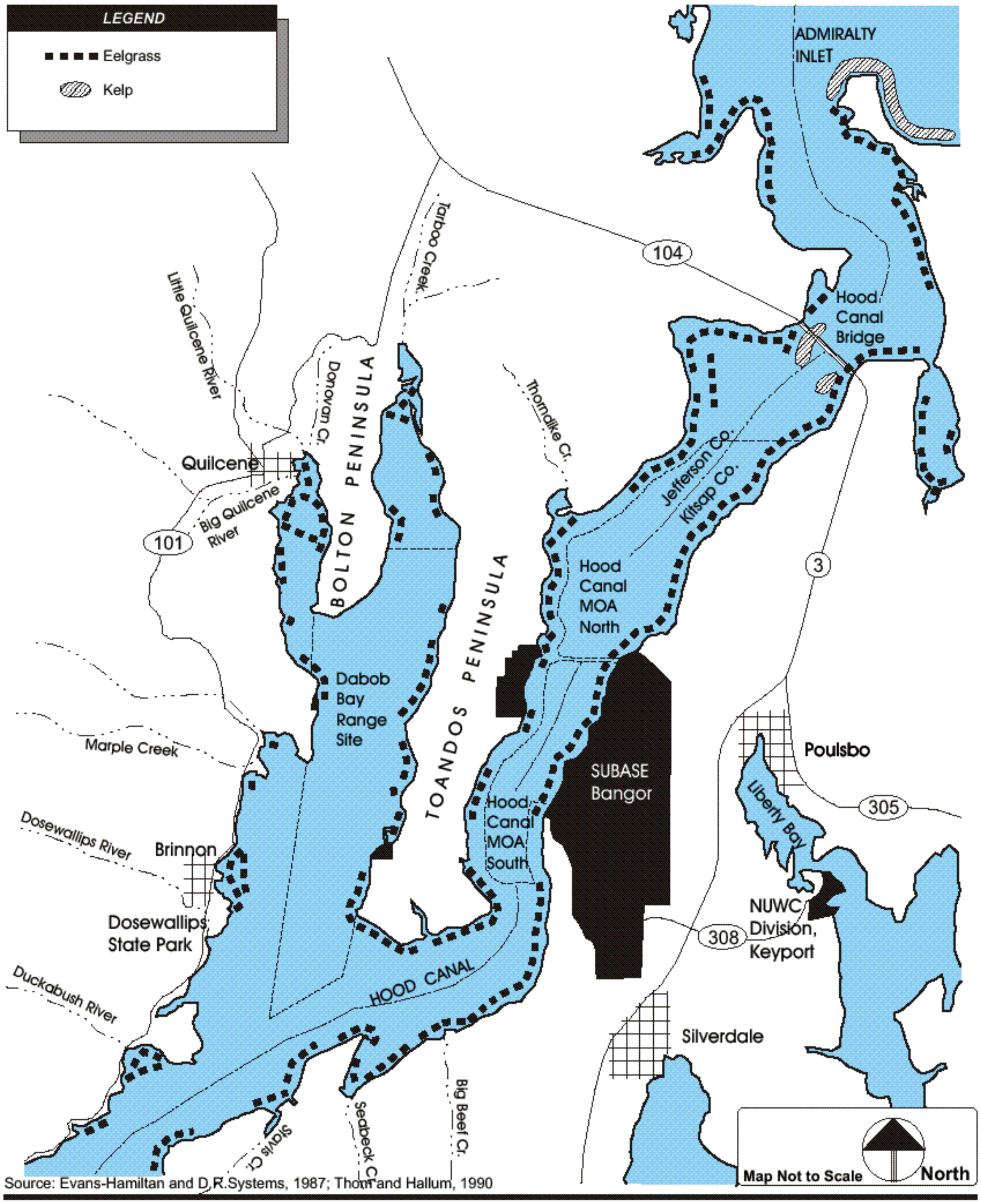
Macroalgae

According to a survey conducted by Phillips and Fleenor (1970), conspicuous macroalgae represented in the project area include *Ulva*, *Enteromorpha,* and *Fucus* found in the littoral zone. *Sargassum* is also present but the plants often disappear during the winter. As with intertidal algae, kelp are poorly represented in the area and are characterized by *Laminaria saccharina*, *Agarum fimbriatum* and *Costaria costata*. In the subtidal zone, the flora is dominated by a host of red algal species. Phillips and Fleenor (1970) also noted an absence of bull kelp (*Nereocystis luetkeana*) beds in Dabob Bay and northern Hood Canal. Thom and Hallum (1990) also observed a lack of kelp beds in Hood Canal, finding that only 0.3 to 0.5 percent of the coastline had kelp present. These kelp beds are located north of the Hood Canal MOAs, near the Hood Canal Bridge (Figure 3.4-1).

Eelgrass

Eelgrass (*Zostera* spp.) forms a complex and highly productive ecosystem that is an important component of nearshore habitat in estuaries and bays throughout the Hood Canal and Dabob Bay region (Phillips 1984). Eelgrass meadows are biologically rich habitats, sheltering a diverse group of fish and invertebrate species that are dependent on eelgrass beds for food resources and cover.

Various marine organisms are associated with eelgrass bed habitats (Phillips 1984). Gammarid amphipods are dependent on ingesting eelgrass particles for their growth and development and are preferred prey items of juvenile salmon. Epibenthic harpacticoid copepods are an important food resource for juvenile chum salmon (*Oncorhynchus keta*) and were reported to be four times more prevalent in a stand of eelgrass compared to a neighboring habitat without



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Eelgrass and Kelp Beds in Dabob Bay and Northern Hood Canal

Figure 3.4-1

eelgrass (Simenstad and Kenney 1978). Pacific herring (Clupea pallasi), another commercially important species, utilize eelgrass beds as a spawning substratum to deposit their eggs. Eelgrass beds also serve as a nursery ground for herring. Apart from Pacific herring and juvenile salmon, numerous other commercially important fish are associated with eelgrass meadows.

3.4.1.2 Marine Invertebrates

Marine invertebrate fauna addressed in this analysis include benthic infauna, mollusks, and crustaceans.

Benthic Infauna

Benthic infauna (organisms that dwell within sediment) communities exist in sediments on the bottom of Puget Sound and Hood Canal. The WDOE monitors the health of these communities by analyzing sediment grab samples collected at Puget Sound Ambient Monitoring Program (PSAMP) sediment stations (Llanso 1998). In Dabob Bay and northern Hood Canal, these stations are No. 15 and 14 (Figure 3.1-2).

Benthic infauna communities at Stations 14 and 15 were characterized in 1990 by large numbers of polychaete worms, bivalves, crustaceans, and other invertebrates (Striplin et al. 1991).

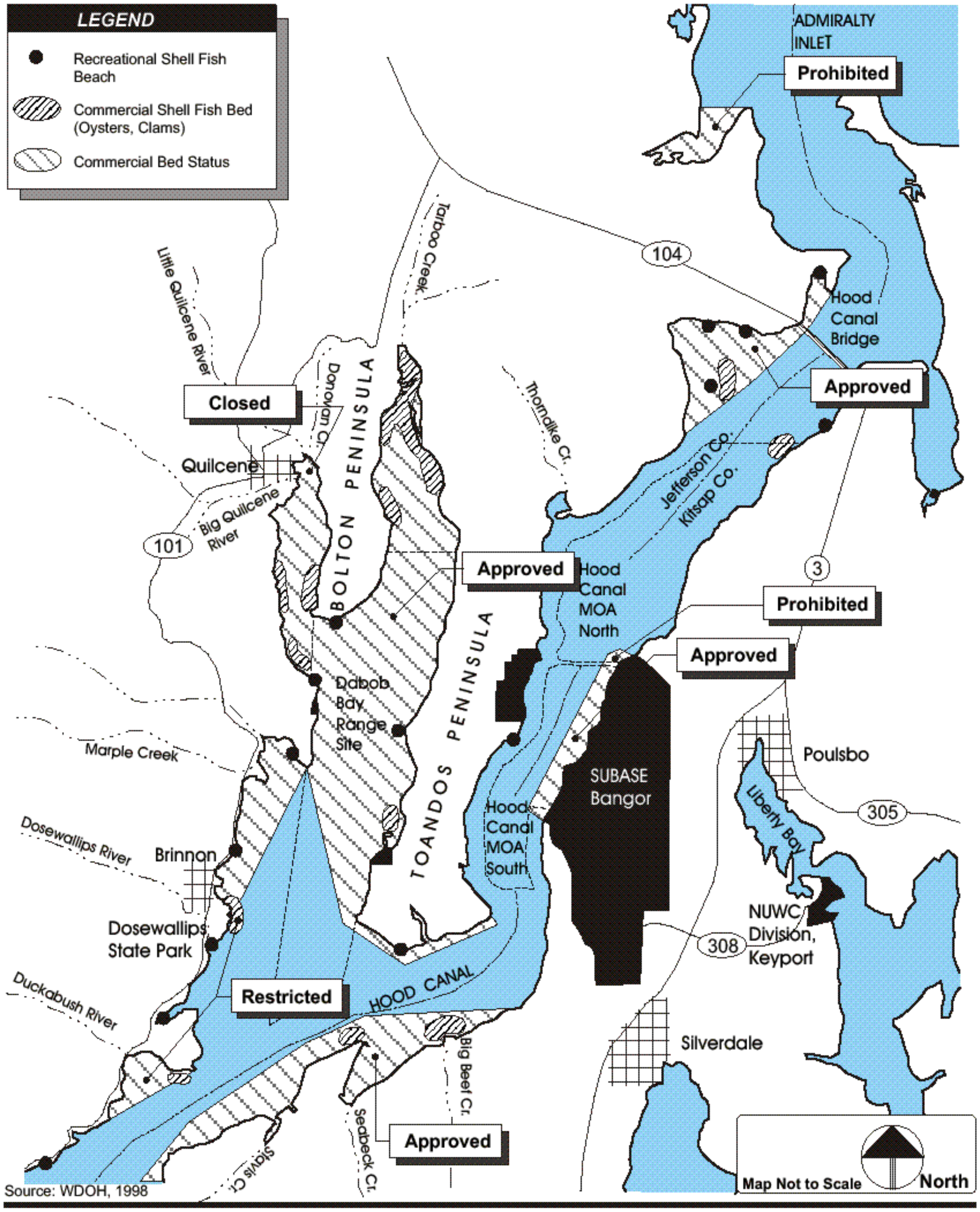
Mollusks

Molluscan shellfish such as oysters, geoducks, and other clams are the basis for important commercial and recreational fisheries, as well as being cultivated in aquaculture operations in Puget Sound, including Hood Canal and Dabob Bay (Figure 3.4-2).

Pacific oysters (*Crassostrea gigas*) are widely cultivated in aquaculture operations in Puget Sound. Commercial oyster beds exist in Dabob Bay, mostly at the north end. Dabob Bay is also one of only three bays on the West Coast in which reliable natural spawning of Pacific oysters takes place (Packer 1980). Thus, Dabob Bay is used for commercial cultching operations, where cultch (such as mesh bags of oyster shells) is set out to act as surfaces for the settling out of planktonic oyster larvae.

There are also two important commercial oyster hatchery operations at the north end of Dabob Bay, in Quilcene, Washington run by Coast Seafoods and Taylor United (Chew 1995). The Point Whitney Shellfish Laboratory, operated by the Washington State Department of Fish and Wildlife (WDFW), is located in Brinnon, Washington, and also runs a shellfish hatchery. These facilities all utilize seawater pumped in from Dabob Bay.

Geoducks (*Panope abrupta*) are large clams found in lower intertidal to subtidal soft bottom habitats in Puget Sound (Emmett et al. 1991).



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Commercial and Recreational Shellfish Beds and Beaches in Dabob Bay and Northern Hood Canal

Figure 3.4-2

In Puget Sound, geoducks can be found in waters as deep as 360 feet (110 m) but are most abundant from -29.8 to -59.7 feet (-9.1 to -18.2 m) below mean low water level (MLLW) (Goodwin 1973). The locations and attributes of geoduck beds have been surveyed in Puget Sound by the WDFW (WDFW 1999a). Figure 3.4-3 shows the location of geoduck beds in Dabob Bay and northern Hood Canal. Most of the beds in Dabob Bay have low average densities. Geoducks are the basis of an important commercial fishery in Puget Sound.

Crustaceans

Dungeness crabs (*Cancer magister*) are the basis of important commercial and recreational fisheries in Puget Sound and Hood Canal (Emmett et al. 1991). Adult Dungeness crabs can be found on mud, rock, and gravel bottoms but prefer sand bottoms (Rudy and Rudy 1983). Juvenile crabs are often found in intertidal eelgrass beds on soft substrata (Armstrong and Gunderson 1985). Dungeness crab can be found in waters as deep as 245 feet (90 m) (Emmett et al. 1991). The recreational fishery for Dungeness crabs takes place from mid-July through mid-April in Hood Canal using crab pots (WDFW 1999b). A Tribal fishery for Dungeness crab by the Skokimish, Jamestown S'Klallam, Port Gamble S'Klallam and Lower Elwha Klallam is conducted year-round from mid-June through the end of May (Point No Point Treaty Council 1999). Tribal fishery openings are announced in annual regulations with periodic updates as needed.

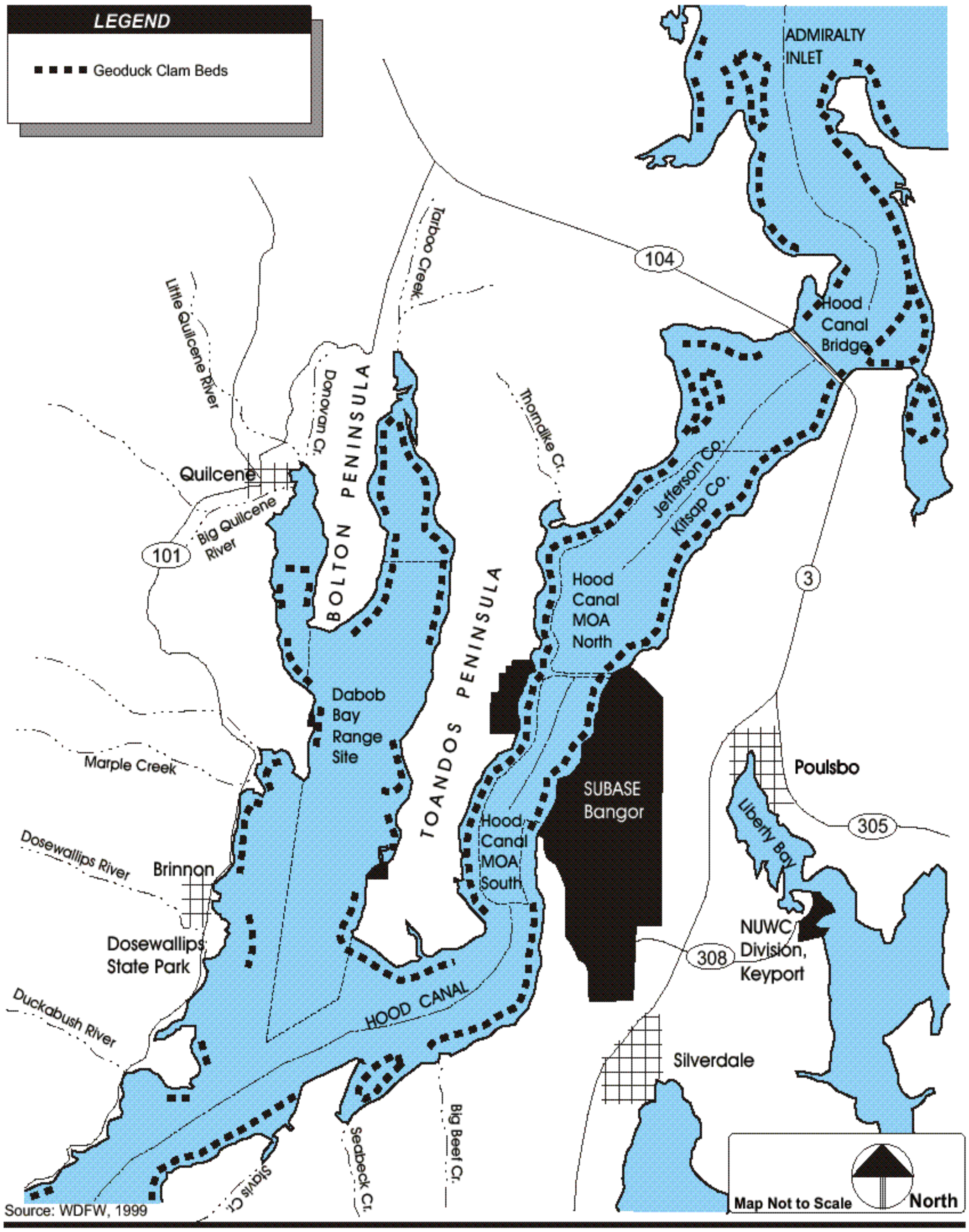
Five species of shrimp in the genus *Pandalus* are the basis of an important recreational fishery in Puget Sound, including Dabob Bay and Hood Canal (WDFW 1999b). This fishery is conducted in May using shrimp pots attached to buoys. There is a Tribal fishery that is open prior to and after the recreation shrimp season and does not typically overlap with the recreation season. Tribal subsistence and commercial fisheries openings for shrimp are announced on a case-by-case (emergency regulation) basis (Point No Point Treaty Council 1999). Pandalid shrimp are associated with benthic habitats ranging from soft to rocky sea bottoms, although some species such as pink shrimp can move up into the water column at night to feed (Jensen 1995).

3.4.1.3 Marine Finfish

Finfish present in the project area include both salmonid and non-salmonid species, as discussed below.

Marine Finfish (Non-Salmonid)

The non-salmonid marine finfish discussed below have been selected as representative of the total number of finfish species present in the Dabob Bay and Hood Canal MOAs. They have been selected for the following reasons: (1) they have been designated as “species of concern” by the U.S. Fish and



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Geoduck Clam Beds in Dabob Bay and Northern Hood Canal

Figure 3.4-3

Wildlife Service (USFWS) (Pacific and river lamprey); (2) they have been selected by the National Marine Fisheries Service (NMFS) for a population status review and possible listing under the Endangered Species Act (ESA); (3) they are species of groundfish which fall under NMFS 'essential fish habitat' (EFH) regulations; (4) they are important forage fish for salmonids, seabirds, and marine mammals; and/or (5) they are the basis of important Tribal, recreational and/or commercial fisheries in Puget Sound and Hood Canal.

Two species of anadromous fish, under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS), that may be in the project area, have been designated as 'species of concern' (Jackson 1999). Species with this designation have no formal status under the ESA, but their conservation status is of concern to the USFWS and additional information is needed. These two species are: (1) the Pacific lamprey (*Lampetra tridentate*), and (2) the river lamprey (*Lampetra ayresi*).

The National Marine Fisheries Service (NMFS) announced on June 21, 1999 that it would conduct a biological status review of seven species of Puget Sound marine fish for consideration of listing these species under the Endangered Species Act (ESA) (64 Federal Register (FR) 33037; June 21, 1999). These seven species are: (1) Pacific herring (*Clupea pallasi*), (2) Pacific cod (*Gadus macrocephalus*), (3) Pacific hake (*Merluccius productus*), (4) walleye pollock (*Theragra chalcogramma*), (5) brown rockfish (*Sebastes auriculatus*), (6) copper rockfish (*S. caurinus*), and (7) quillback rockfish (*S. maliger*). All of these species are present or very likely to be present in the Dabob Bay and Hood Canal MOAs.

Groundfish present in Puget Sound which fall under NMFS 'essential fish habitat' (EFH) regulations (62 FR 66531; 64 FR 49092) are listed in Table 3.4-1. This table also identifies which of these species are present in Dabob Bay and northern Hood Canal, based on distribution maps in Miller and Borton (1980). A number of these fish species are discussed below, along with brief descriptions of their habitat. In general, the types of benthic habitats described below for bottom fish, rockfish, and flatfish also apply to most of these additional species.

Lampreys

The Pacific lamprey is found from southern California to the Gulf of Alaska (Wydoski and Whitney 1979). It is also found in Japan on the Island of Hokkaido. They are parasitic fish in marine waters, attaching themselves to other fish including salmonids. They are anadromous fish, returning to fresh water rivers to spawn. In Washington State, they are found in large coastal rivers including the Columbia River and its tributaries. It is likely present in the large river systems in Hood Canal.

Table 3.4-1: Species of fish covered by 'essential fish habitat' regulations present in Puget Sound.

COMMON NAME	LATIN NAME	PRESENT IN DABOB BAY?	PRESENT IN N. HOOD CANAL?
GROUNDFISH SPECIES			
spiny dogfish	*Squalus acanthias*	Yes	yes
big skate	*Raja binoculata*	Yes	yes
California skate	*Raja inornata*	N/a	N/a
longnose skate	*Raja rhina*	Yes	yes
ratfish	*Hydrolagus colliei*	Yes	yes
lingcod	*Ophiodon elongatus*	Yes	yes
cabezon	*Scorpaenichthys marmoratus*	Yes	yes
kelp greenling	*Hexagrammos decagrammus*	No	no
Pacific cod	*Gadus macrocephalus*	Yes	yes
hake	*Merluccius productus*	Yes	yes
sablefish	*Anoplopoma fimbria*	Yes	yes (connecting waters only)
jack mackeral	*Trachurus symmetricus*	No	no
black rockfish	*Sebastes melanops*	Yes	no
bocaccio	*Sebastes paucispinis*	Yes	no
brown rockfish	*Sebastes auriculatus*	Yes	yes
canary rockfish	*Sebastes pinniger*	No	no
China rockfish	*Sebastes nebulosus*	No	no
copper rockfish	*Sebastes caurinus*	Yes	yes
darkblotch rockfish	*Sebastes crameri*	No	no
greenstriped rockfish	*Sebastes elongatus*	Yes	yes
Pacific ocean perch	*Sebastes alutus*	No	no
quillback rockfish	*Sebastes maliger*	Yes	yes (connecting waters only)
redbanded rockfish	*Sebastes babcocki*	No	no
redstripe rockfish	*Sebastes proriger*	Yes	no
rosethorn rockfish	*Sebastes helvomaculatus*	No	no
rosy rockfish	*Sebastes rosaceus*	No	no
rougheye rockfish	*Sebastes aleutianus*	No	no
sharpchin rockfish	*Sebastes zacentrus*	No	no
shortspine thornyhead	*Sebastolobus alascanus*	No	no
splitnose rockfish	*Sebastes diploproa*	Yes	no
striptail rockfish	*Sebastes saxicola*	No	yes
tiger rockfish	*Sebastes nigrocinctus*	No	no
vermilion rockfish	*Sebastes miniatus*	No	no
yelloweye rockfish	*Sebastes ruberrimus*	No	no
yellowtail rockfish	*Sebastes flavidus*	No	yes
arrowtooth flounder	*Atheresthes stomias*	Yes	yes
butter sole	*Isopsetta isolepis*	Yes	no
curlfin sole	*Pleuronichthys decurrens*	N/a	N/a
Dover sole	*Microstomus pacificus*	Yes	yes
English sole	*Parophrys vetulus*	Yes	yes
flathead sole	*Hippoglossoides elassodon*	Yes	yes
Pacific sanddab	*Citharichthys sordidus*	Yes	yes
petrale sole	*Eopsetta jordani*	Yes	yes (connecting waters only)
rex sole	*Glyptocephalus zachirus*	Yes	yes
rock sole	*Lepidopsetta bilineata*	Yes	yes

COMMON NAME	LATIN NAME	PRESENT IN DABOB BAY?	PRESENT IN N. HOOD CANAL?
sand sole	*Psettichthys melanostictus*	Yes	yes
starry flounder	*Platichthys stellatus*	Yes	yes
PELAGIC SPECIES			
anchovy	*Engraulis mordax*	Yes	no
Pacific sardine	*Sardinops sagax*	No	no
Pacific mackerel	*Scomber japonicus*	No	no
market squid	*Loligo opalescens*	N/a	N/a

Source: Distribution in Dabob Bay and northern Hood Canal from Miller and Borton (1980); ROC, Donnelly, 2000.

After spending an unknown amount of time at sea as parasites on other fish, Pacific lampreys enter river systems in late spring/early summer. They spawn in June and July, forming gravel nests in riffle areas, and die soon after (Wydoski and Whitney 1979). The lamprey larvae (or ammocoetes) live in freshwater environments for up to 6 years, during which time they are filter feeders in quiet water areas with fine silt bottoms. After reaching maturity, the larvae migrate from their home stream to the ocean from March to July, with peak migrations in April and June. Thus, it is likely that Pacific lamprey are present annually in the marine waters of Dabob Bay and northern Hood Canal during the time period from March through July as both adults and juveniles.

The river lamprey is found in coastal rivers and streams from central California to Southeast Alaska (Wydoski and Whitney 1979). Its distribution in Washington State is not known, but it is thought to be present in most major rivers. It is likely present in rivers draining into Hood Canal. The biology and life history of the river lamprey is relatively unknown but is thought to be similar to the Pacific lamprey. It is anadromous and is parasitic on other fishes, including herring. It is likely that river lamprey are present in the marine waters of Dabob Bay and northern Hood Canal at similar life stages and times as the Pacific lamprey.

Forage Fish

Forage fish (or baitfish) are important prey items for other finfish, including salmonids, marine mammals, and seabirds in Puget Sound and Hood Canal (WDFW 1995). Important forage fish in Puget Sound include: (1) Pacific herring, (2) surf smelt, and (3) sand lance. Herring are used as baitfish in recreational fisheries and are the subject of commercial fisheries in Puget Sound. Surf smelt are also both recreationally and commercially caught, whereas sand lance are not the basis for any significant fisheries.

Pacific herring, in the Family Clupeidae, are found on both sides of the North Pacific Ocean (Hart 1980). In North America, they are found from northern Baja California to Alaska and on the Arctic Ocean coastline to Cape Bathurst in the Northwest Territories in Canada.

In Hood Canal, there are three stocks of Pacific herring: (1) the Port Gamble stock at the north end of Hood Canal in Port Gamble Bay and vicinity, (2) the Quilcene Bay stock in Dabob Bay and on the Kitsap Peninsula in Seabeck and Stavis Bays, and (3) the south Hood Canal stock in Hood Canal past the Great Bend and in Lynch Cove (WDFW 1995; WDFW 1997). The Port Gamble and Quilcene Bay stock spawning grounds are shown in Figure 3.4-4. The Quilcene Bay stock spawns from the beginning of February through mid-April, and the Port Gamble stock spawns from mid-January through mid-April (WDFW 1995). While Pacific herring are the basis for two commercial fisheries in Puget Sound, there is no identified commercial fishery for herring in Hood Canal. Recreational fisheries for herring are relatively insignificant.

Surf smelt, in the family Osmeridae, are found from Long Beach, California to Chignik Lagoon on the Alaska Peninsula (WDFW 1997). In central and southern Puget Sound and Hood Canal, surf smelt deposit their eggs at high tide slack in upper intertidal areas in the fall and winter. Surf smelt deposit their adhesive eggs on beaches with a coarse sand/pea gravel substrate (1 to 7 mm diameter) (Penttila 1978). Surf smelt spawning beaches have been documented in the Dabob Bay and Hood Canal MOAs and vicinity (Figure 3.4-4).

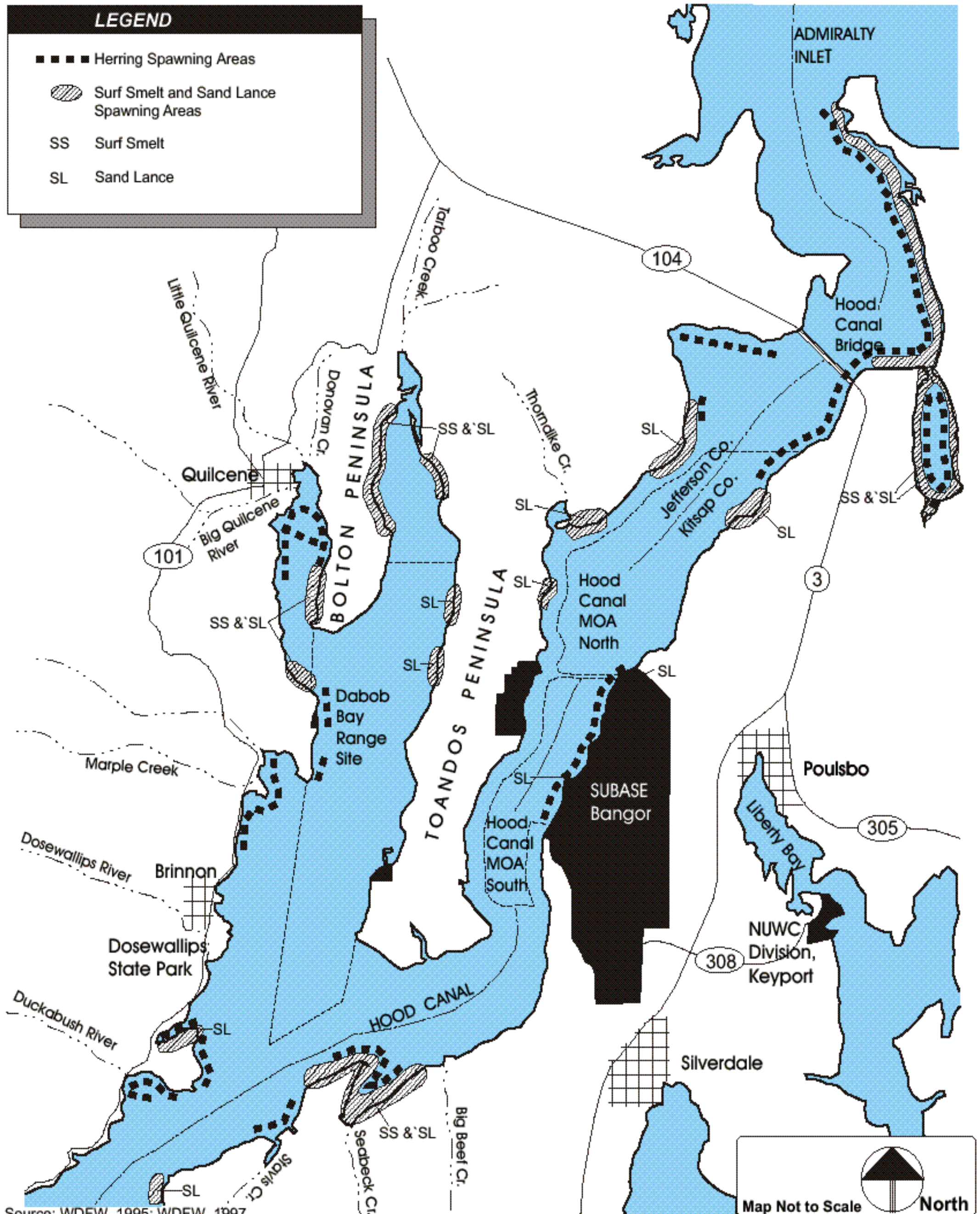
There are both recreational and commercial fisheries for surf smelt in Puget Sound and Hood Canal (WDFW 1997). Recreational fisheries consist of the use of dip-nets, rakes, or "jigging gear" to catch fish. Recreational fisheries exist in southern Hood Canal at Twanoh State Park with potential fisheries at Seabeck and Scenic Beach State Park, just south of Dabob Bay. Commercial drag and purse seine fisheries exist in Puget Sound and Hood Canal. The Hood Canal catch provided 23,151 lbs (10,418 kg) taken from October 1 through November 30, 1995 and represented 20 percent of the 1995 harvest.

Pacific sand lance, in the family Ammodytidae, are found from southern California to the Bering Sea in North America, and from Alaska to the Sea of Japan in Asia (Emmett et al. 1991). The sand lance spawns from approximately the beginning of November to mid February / late March in Puget Sound (Penttila 1995), depositing their adherent eggs in the upper intertidal zone. Sand lance spawning beaches in Dabob Bay and northern Hood Canal are shown in Figure 3.4-4. Sand lance are not the basis for any significant fisheries (WDFW 1997).

Bottom Fish

Bottom fish such as rockfish, flatfish, cod, pollock, surfperch, and lingcod form the basis of important recreational fisheries in Puget Sound and Hood Canal (Matthews 1987; Emmett et al. 1991). Flatfish are also the basis of an important commercial fishery in Puget Sound.

Rockfish in the family Scorpaenidae are represented in Puget Sound and Hood Canal by members of the genera *Sebastes* and *Sebastodes* (Hart 1980). Rockfish are the basis of an important recreational fishery in Puget Sound,



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Herring, Surf Smelt, and Sand Lance Spawning Areas and Beaches in Dabob Bay and Northern Hood Canal

Figure 3.4-4

with the three most commonly caught species being: (1) copper rockfish, (2) quillback rockfish, and (3) brown rockfish (Matthews 1987).

All three species are found in the marine waters of the Dabob Bay and Hood Canal MOAs, although the brown rockfish are lower in abundance. Copper, quillback, and brown rockfish are found in rocky subtidal habitats in Puget Sound in less than 98 feet (30 m) of water (Matthews 1990).

English sole (*Pleuronectes vetulus*) are demersal flatfish associated with shallow, soft-bottom (sand and mud) habitats in Puget Sound (Emmett et al. 1991). It is the most numerous flatfish in Puget Sound and is the basis for a commercial fishery. English sole are present in Hood Canal, including waters of the Dabob Bay and Hood Canal MOAs.

Starry flounder (*Platichthys stellatus*) are also demersal flatfish associated with mud, sand, and gravel bottoms (Emmett et al. 1991). It is both the basis of a commercial fishery in Puget Sound and a fairly large recreational fishery. Starry flounder are found both in marine and estuarine areas, including low salinity tidal areas of rivers. Starry flounder are present in Hood Canal, including waters of the Dabob Bay and Hood Canal MOAs. Other species of bottom fish are also the basis of important recreational fisheries in Puget Sound. These species, which are present in the waters of the Dabob Bay and Hood Canal MOAs, include: (1) Pacific cod, walleye pollock, and Pacific hake in the family Gadidae; (2) pile surfperch and striped surfperch in the family Embiotocidae; (3) lingcod and kelp greenling in the Family Hexagrammidae; and (4) cabezon in the family Cottidae (Matthews 1987; Miller and Borton 1980).

Pacific cod are found in waters from 164 to 656 feet (50 to 200 m) deep, associated with mixed-coarse and mixed-fine sand substrata on the bottom of Puget Sound (Matthews 1987). Walleye pollock are pelagic and semi-demersal fish. Numerically they are the most caught recreational bottom fish in Puget Sound. Pollock juveniles are associated with eelgrass beds and gravel and cobble habitats (Miller et al. 1976). Adult pollock are semi-demersal near the bottom of Puget Sound but are not associated with any particular substratum (WDOE 1981). Pacific hake (or whiting) are semi-demersal fish off the outer coast from California to British Columbia, as well as being present in inland waters (Goni 1988). In the Strait of Georgia and Puget Sound, it is the most abundant resident fish.

Pile surfperch and striped surfperch are shallow, nearshore fish and are the basis for a recreational fishery from piers and breakwaters (Matthews, 1987). Surfperch are abundant in rocky areas of Puget Sound and are found commonly found associated with docks, pilings, and other shoreline structures (WDOE 1981). Both juvenile and adult surfperches are abundant in eelgrass beds (Phillips 1984).

Lingcod are demersal fish living on and adjacent to rocky bottoms and reefs in Puget Sound (Matthews 1987). Juvenile lingcod are found on sandy bottom areas adjacent to rocky reefs, with larger lingcod dwelling on rocky reefs. Female lingcod deposit their eggs in masses directly onto rocks in lower intertidal, shallow subtidal areas. These nest areas are then guarded by male lingcod. Cabezon are associated with shallow rocky reefs in Puget Sound (Miller and Borton 1980). Juvenile cabezon are found in cobble, sand and eelgrass habitats, whereas adult cabezon are found on rocky reefs in waters less than 98 feet (30 m) deep (Miller et al. 1976).

Salmonids

Five salmonid species (or stocks) are present in the project area that do not have any formal status under the ESA (Table 3.4-2). Species with ESA status are discussed in Section 3.6. Potential effects of ongoing and future operations of the Dabob Bay and Hood Canal MOAs on these salmonids are addressed in this document. The Puget Sound/Strait of Georgia Evolutionarily Significant Unit (ESU) of coho salmon (*Oncorhynchus kisutch*) was designated as a candidate for listing under the ESA in July of 1995 (60 FR 38011). The other salmonid species are: (1) steelhead trout (*Oncorhynchus mykiss*), (2) coastal cutthroat trout (*Oncorhynchus clarki*), (3) pink salmon (*Oncorhynchus gorbuscha*), and (4) fall-run populations of chum salmon.

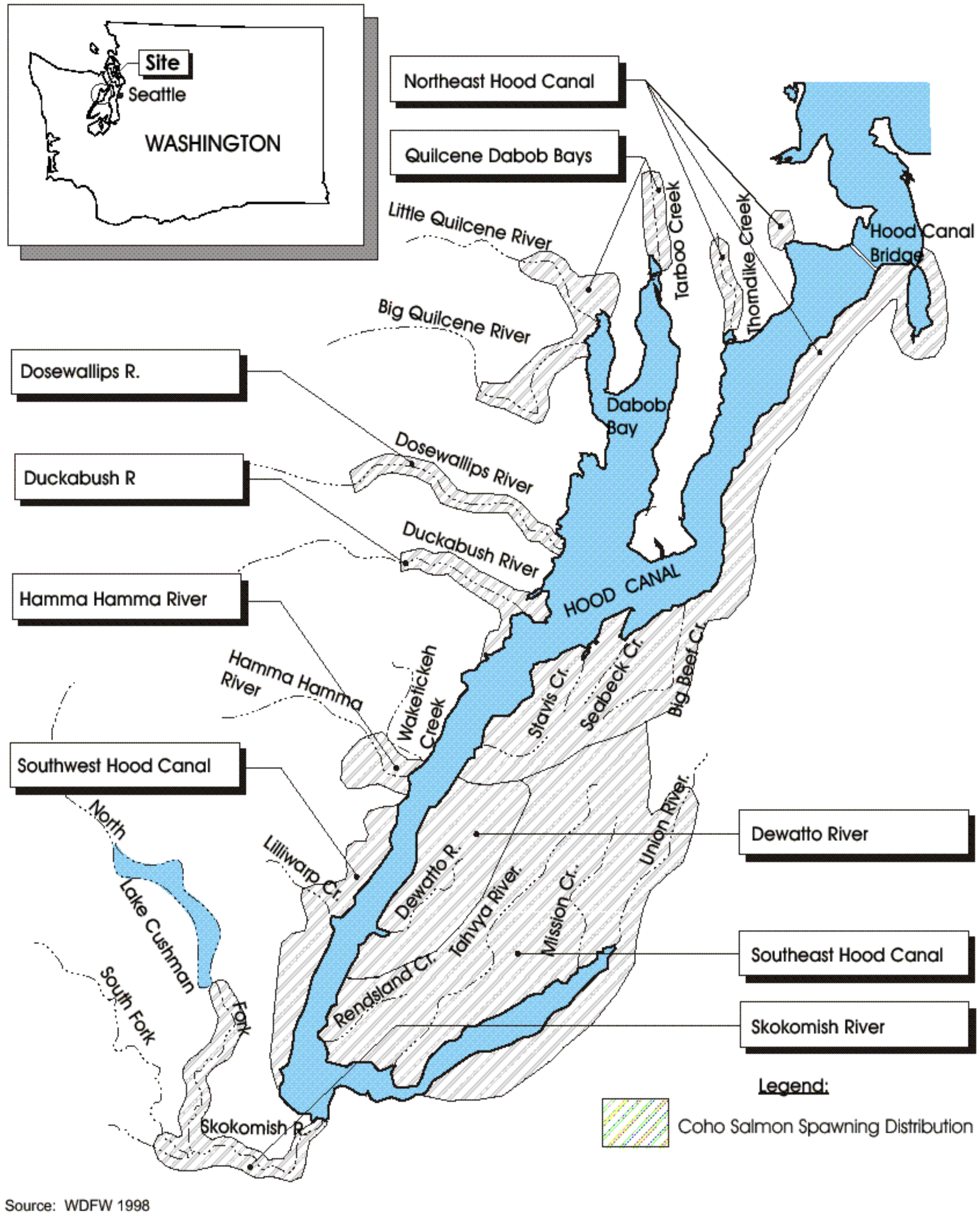
Table 3.4-2: Life Stages of Non-Threatened Salmonids in the Dabob Bay and Hood Canal MOAs.

Species/ESU	In-Migrating Adults	Out-Migrating Juveniles
Puget Sound / Strait of Georgia coho salmon	Early August to end of December	mid-February to end of July
Steelhead trout	December through May (winter-run) May through October (summer-run)	April through June
Coastal cutthroat trout	October through January	January through July
Pink salmon	mid-July through mid-October (in odd-numbered years)	January through mid-June (in even-numbered years)
Fall-run chum salmon	Early October through early January	January through end of July

There is a salmon fishery in Dabob Bay and northern Hood Canal from August 1 through October 15, but chinook, (Oncorhynchus tshawytscha) chum, and pink salmon are required to be released to protect wild stocks (WDFW 1999b). In addition, there is a chinook salmon fishery (resident blackmouth) from October 16 to December 31, and from February 16 to April 10, for fish greater than 22 inches (56 cm).

Puget Sound / Strait of Georgia Coho Salmon

In general, coho salmon are thought to utilize accessible portions of all rivers, tributaries, and streams entering Hood Canal (Figure 3.4-5) (Williams et al. 1975; WDFW and WWTIT 1994). The WDFW breaks Hood Canal coho salmon stocks into nine geographical groups of rivers (WDFW and WWTIT 1994). Of these stocks, only the Skokomish River, southwest Hood Canal, Hamma Hamma River, and Dosewallips River coho salmon stocks are considered healthy, whereas all other stocks are depressed (Table 3.4-3).



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Hood Canal Coho Salmon Runs

Figure 3.4-5

Table 3.4-3: Coho Salmon Populations Status in Hood Canal by River or Group of Rivers and Creeks.

River/Area	Population Status
Northeast Hood Canal	Depressed
Quilcene/Dabob Bays	Depressed
Dosewallips River	Healthy
Duckabush River	Depressed
Hamma Hamma River	Healthy
Southwest Hood Canal	Healthy
Skokomish River	Healthy
Southeast Hood Canal	Depressed
Dewatto River	Depressed

Source: WDFW and WWTIT 1994

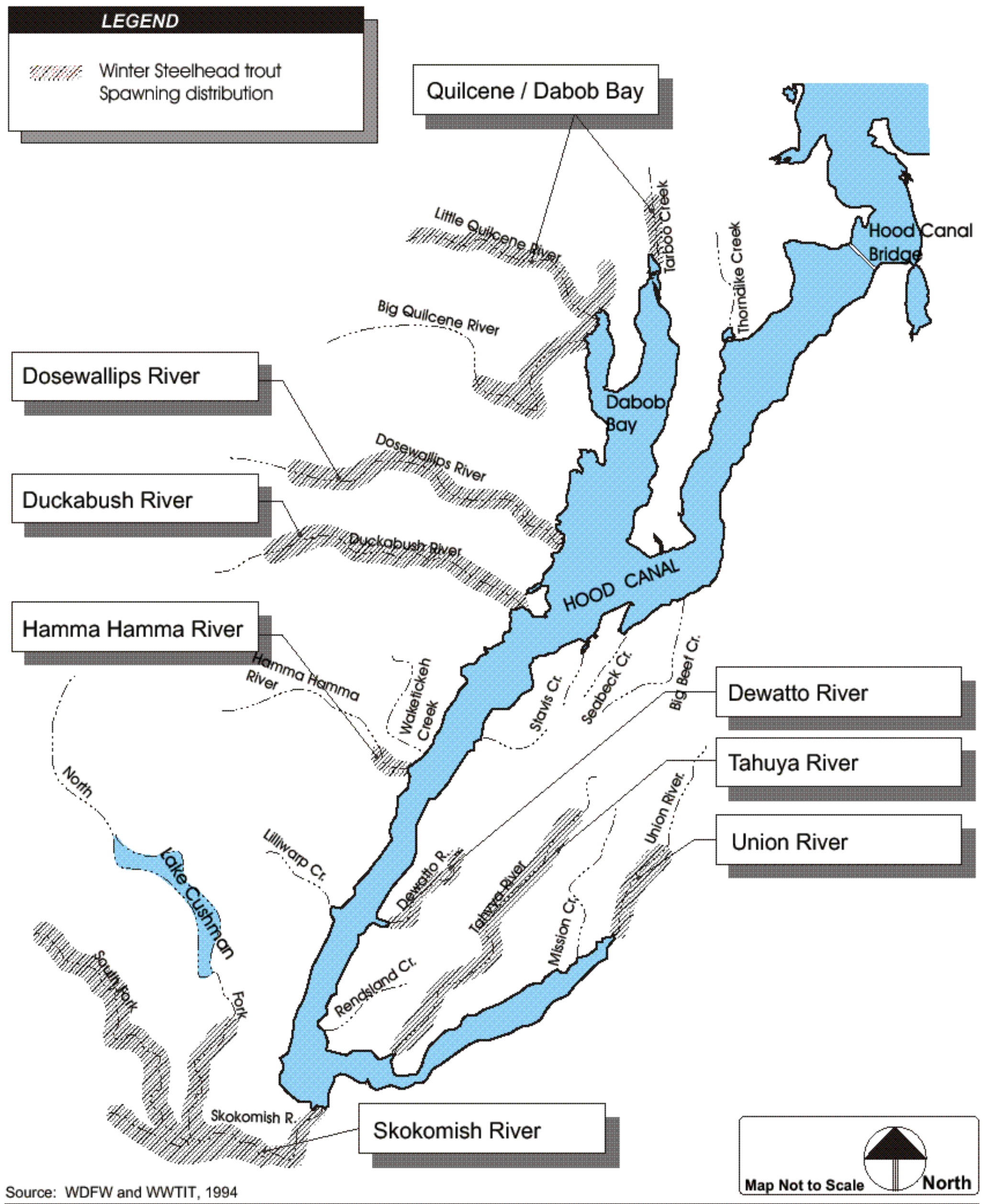
Coho salmon adults return from the open ocean and migrate up rivers and streams in Hood Canal from early August through the end of December (Williams et al. 1975). They spawn from the beginning of October through mid-January, with intragravel egg development from the beginning of October through mid-May. Juvenile freshwater rearing is year round, with out-migration to estuarine areas lasting from mid-February through mid-July. Out-migrating juvenile coho salmon smolts were caught at Bangor on Hood Canal from April through July with a peak in May in studies conducted from 1976 to 1979 (Bax et al. 1978, 1980; Schreiner et al. 1977). These studies found that migrating juvenile salmon were found primarily in nearshore areas in the top few meters of the water column, mainly on the east side of Hood Canal.

Returning adult Puget Sound coho salmon are present annually in marine waters of the Dabob Bay and Hood Canal MOAs from early August through the end of December. Adult salmon returning to Puget Sound tend to be found in the upper 30 feet (9.1 m) of the water column (WDFW 1999b). Out-migrating juvenile coho salmon are present in Hood Canal from mid-February through the end of July (primarily nearshore in the top few meters of water).

Steelhead Trout

Steelhead trout are anadromous trout and were historically found in rivers and streams from northern Mexico to southeastern Alaska (Wydoski and Whitney 1979). They have been eliminated south of San Francisco Bay due to human activities. Rainbow trout are the non-anadromous form of this fish. After spending two or three years at sea in the North Pacific Ocean, they return to their native rivers either in the summer or winter.

In Hood Canal there are three summer-run populations and eight winter-run populations of steelhead (Figure 3.4-6) (WDFW and WWTIT 1994). Summer-run populations return to their native streams and begin upstream migration from May through October. Winter-run populations return to and begin ascending their native streams from December through May. The status



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Hood Canal Winter Steelhead Trout Runs

Figure 3.4-6

of the three summer-run steelhead populations in the Dosewallips, Duckabush, and Skokomish rivers is unknown. In addition, the status of three winter-run populations in Quilcene and Dabob bays, the Hamma Hamma River, and the Union River is also unknown. The status of the remaining five winter-run steelhead populations in Hood Canal, in the Dosewallips, Duckabush, Skokomish, Tahuya, and Dewatto rivers is considered depressed (Table 3.4-4).

Table 3.4-4: Summer-Run and Winter-Run Steelhead Population Status in Hood Canal by River or Group of Rivers and Streams.

River/Area	Population Status
Quilicene/Dabob Bays (Winter-run)	Unknown
Dosewallips River (Summer-run)	Unknown
Dosewallips River (Winter-run)	Depressed
Duckabush River (Summer-run)	Unknown
Duckabush River (Winter-run)	Depressed
Hamma Hamma River (Winter-run)	Unknown
Skokomish River (Summer-run)	Unknown
Skokomish (Winter-run)	Depressed
Union River (Winter-run)	Unknown
Tahuya River (Winter-run)	Depressed
Dewatto River (Winter-run)	Depressed

Source: WDFW and WWTIT 1994

Adult steelhead returning to their native rivers in Hood Canal are present in the marine waters of the Dabob Bay and Hood Canal MOAs from December through May and May through October (winter- and summer-run populations). Out-migrating juvenile steelhead are present from April through June.

It is assumed that in-migrating adult and out-migrating juvenile steelhead would utilize similar water column positions as has been shown for salmon (i.e., in-migrating adult salmon tend to be found in the upper 30 feet [9.1 m], and out-migrating juvenile salmon utilize nearshore, shallow areas in the upper 3 to 6 feet [0.9 to 1.8 m] of the water column) (WDFW 1999b; Bax 1983; Schreiner 1977).

Coastal Cutthroat Trout

The coastal or sea-run cutthroat trout is the anadromous form of cutthroat trout, the other form residing strictly in freshwater (Wydoski and Whitney 1979). The coastal form of cutthroat trout is found in rivers and streams from northern California through southeastern Alaska, including the rivers and streams entering the waters of Puget Sound and Hood Canal. No information was located on cutthroat populations associated with particular rivers in Hood Canal, although they have been found in field studies in Hood Canal. Leider (1997) stated that the status of Hood Canal stocks of sea-run cutthroat was unclear, but both depressed and healthy populations were likely present.

Pink Salmon

In-migrating pink salmon runs occur only in odd numbered years in Puget Sound and the Fraser River (Heard 1991). In rivers entering Hood Canal, pink salmon stocks are found in just three rivers, the Dosewallips, Duckabush, and Hamma Hamma rivers (Figure 3.4-7) (WDFW and WWTIT 1994). Historically, a small pink salmon stock was also found in the Skokomish River (Williams et al. 1975). The population status of the pink salmon stock utilizing the Dosewallips River was rated as depressed, whereas the stocks in the Duckabush and Hamma Hamma rivers were assessed as healthy (Table 3.4-5; WDFW and WWTIT 1994).

Table 3.4-5: Hood Canal Pink Salmon Population Status by River.

River	Population Status
Dosewallips River	Depressed
Duckabush River	Healthy
Hamma Hamma River	Healthy

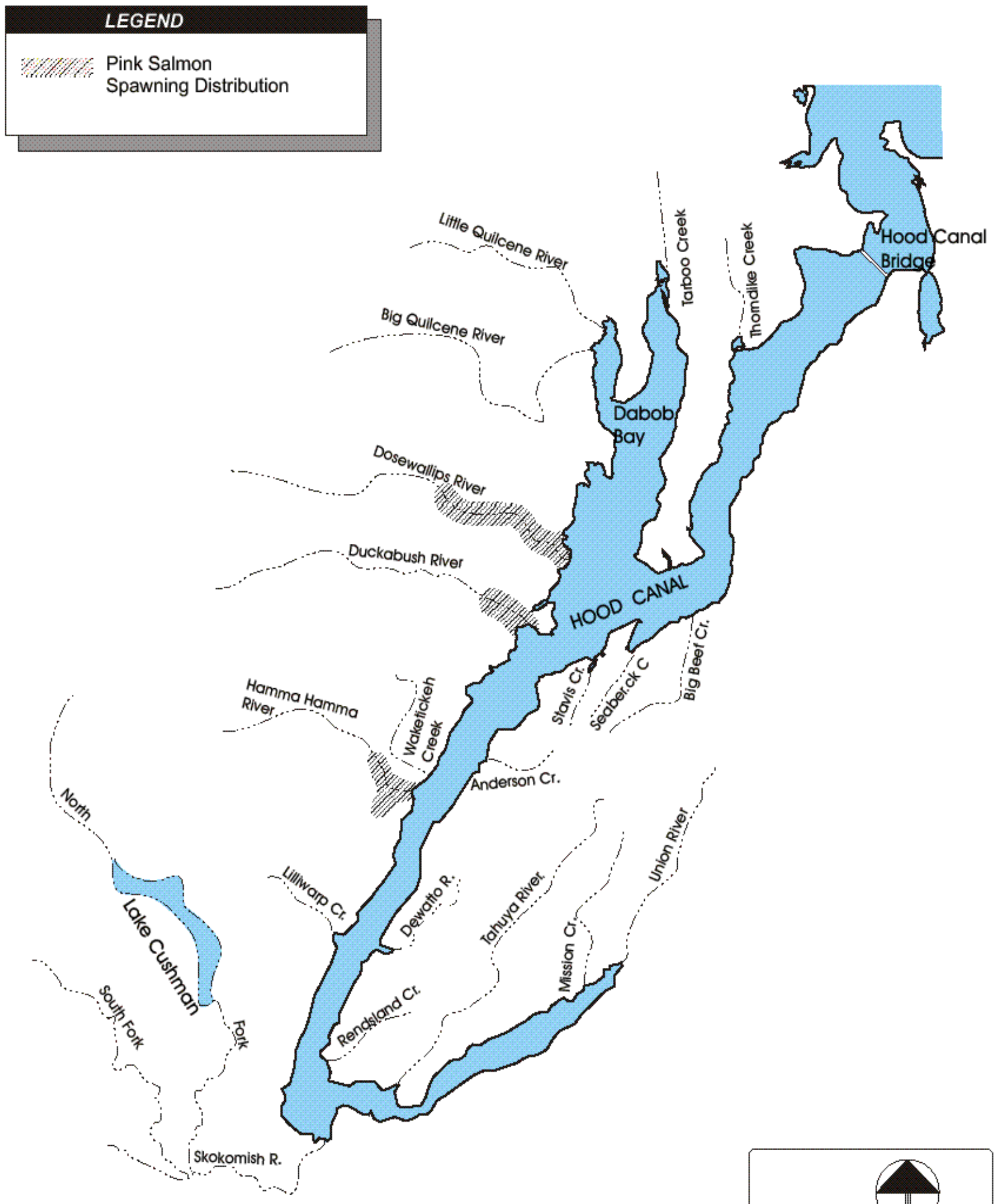
Source: WDFW and WWTIT 1994.

Adult pink salmon returning to their native rivers in Hood Canal are present in the marine waters of the Dabob Bay and Hood Canal MOAs in odd-numbered years, from mid-July through mid-October. In-migrating adult salmon tend to be found in the upper 30 feet (9.1 m) of the water column (WDFW 1999b). Out-migrating juvenile pink salmon are present in shallow, nearshore marine waters of Dabob Bay and Hood Canal from January through mid-June.

Fall-Run Chum Salmon

Chum salmon have historically utilized almost all accessible rivers and streams entering Hood Canal and Dabob Bay (Williams et al. 1975). There are fall-run chum salmon stocks in almost all of these rivers, with a smaller number of rivers and streams having summer-run stocks as well. Fall-run chum salmon in Hood Canal are characterized as those fish that enter their home rivers starting in October and November and spawn from November through January. Summer-run chum salmon enter their native rivers starting in August and September and spawn from mid-September through October.

There are ten populations of fall-run chum salmon in Hood Canal (Figure 3.4-8) (WDFW and WWTIT 1994). Early fall runs are found in rivers and streams in the Northeast Hood Canal, West Hood Canal, and Southeast Hood Canal areas, and in the lower Skokomish and Dewatto rivers. Late fall runs are found in rivers and streams entering Quilcene Bay and in the Dosewallips, Duckabush, Hamma Hamma, and upper Skokomish rivers. Fall-run chum salmon populations in all of these areas and rivers are considered healthy, with the exception of the lower Skokomish River population, whose status is unknown (Table 3.4-6). A series of studies on out-migrating juvenile salmon in the vicinity of Bangor on Hood Canal was conducted from 1976 to 1979 (Bax et al. 1978, 1980; Schreiner et al. 1977).



Source: WDFW and WWTIT, 1994

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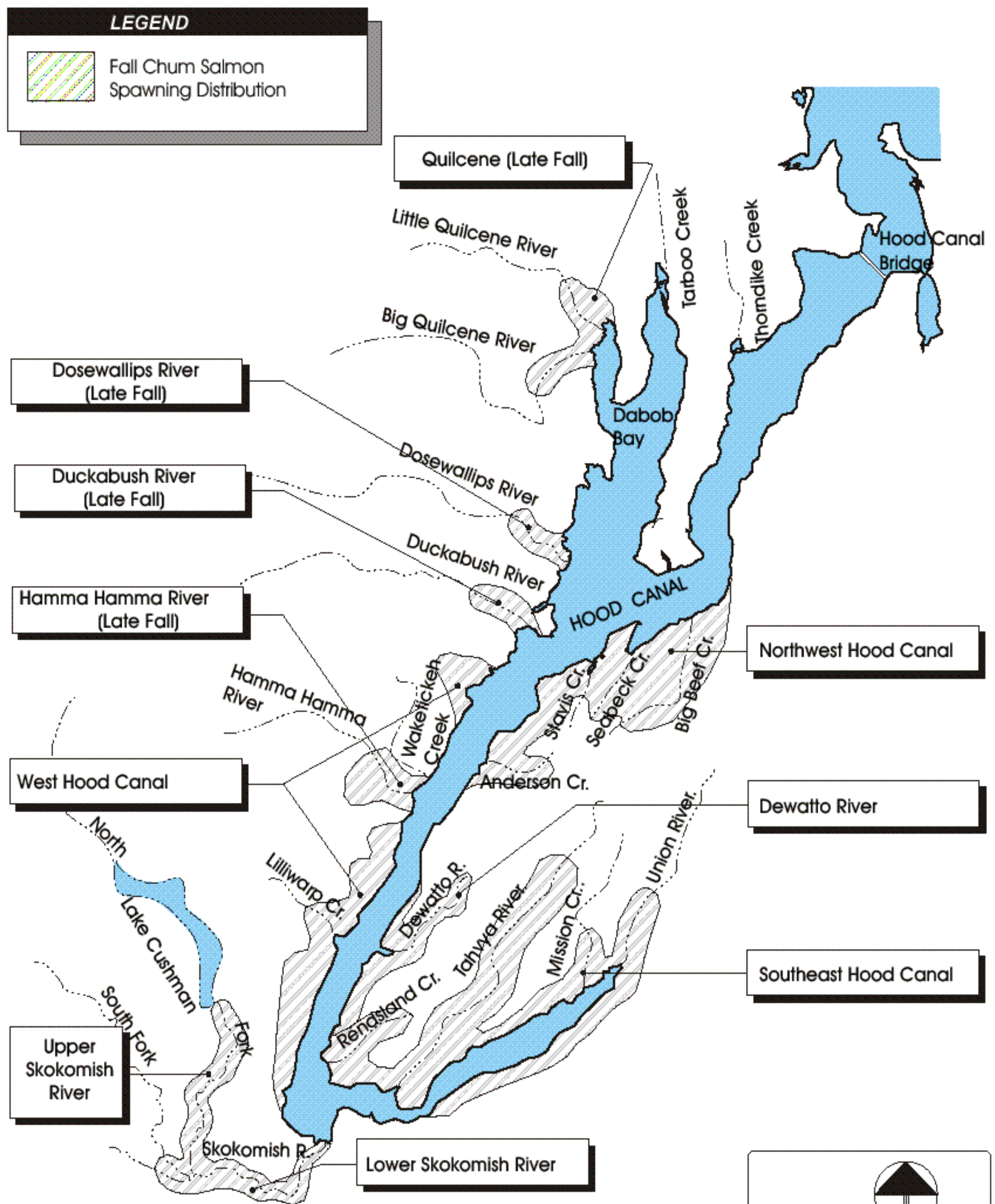
Hood Canal
Pink Salmon Runs

Figure 3.4-7



Source: WDFW and WWTIT, 1994

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Hood Canal
Fall Chum Salmon Runs

Figure 3.4-8

Table 3.4-6: Fall-run Chum Salmon Population Status in Hood Canal by River or Group of Rivers and Streams.

River/Area	Population Status
Northeast Hood Canal	Healthy
Quilcene Bay (late fall)	Healthy
Dosewallips River (late fall)	Healthy
Duckabush River (late fall)	Healthy
Hamma Hamma River (late fall)	Healthy
West Hood Canal	Healthy
Lower Skokomish River	Unknown
Upper Skokomish River (late fall)	Healthy
Southeast Hood Canal	Healthy
Dewatto River	Healthy

Source: WDFW and WWTIT 1994.

Out-migrating juvenile chum salmon were caught in nearshore shallow areas, primarily on the eastern shoreline of Hood Canal, from January through July.

Timing of minor and major peaks in abundance and major peaks recorded in mid-April or from mid-May through mid-July.

Adult fall-run chum salmon returning to their native rivers in Hood Canal are present in the marine waters of the Dabob Bay and Hood Canal MOAs from early October through early January. In-migrating adult salmon tend to be found in the upper 30 feet (9.1 m) on the water column (WDFW 1999b).

Out-varied from year to year, with early minor peaks in early February or March migrating juvenile fall-run chum salmon are present in shallow, nearshore marine waters of Dabob Bay and Hood Canal from January through the end of July.

3.4.1.4 Marine Mammals

Marine mammals that occur in the DBRC include resident species present all year, species that occur in the vicinity on a seasonal basis, and those that are rare visitors to Puget Sound. Table 3.4-7 indicates the marine mammal species that could occur in the project area.

Mysticetes

The baleen whales, or Mysticeti, have baleen plates instead of teeth, which are composed of bristles that form a net used to strain small organisms from seawater or sediment. There are no resident whales in Puget Sound waters; however, three species (the minke [*Balaenoptera acutorostrata*], gray [*Eschrichtius robustus*], and humpback whales [*Megaptera novaeanngiliae*]) are likely to occur as occasional visitors. Humpback whales are described under Threatened and Endangered Species (Section 3.6). Minke whales are uncommon visitors to the Hood Canal and Dabob Bay and are not included in the impact analysis. Gray whales grow to 45 feet (13.7 m) long and can weigh

Table 3.4-7: Marine Mammals that Potentially Occur in the DBRC.

Species	Status	Hearing/Sound Production	Distribution in Puget Sound
Mysticetes			
Minke Whale *Balaenoptera acutorostrata*	IUCN[1] – lower risk/near threatened species	No hearing data available. Many types of sounds produced in the 80 – 5,000 Hz range with pings and clicks from 3.3 kHz-20 kHz.	Rare, coastal resident
Humpback Whale *Megaptera novaeangiliae*	ESA[2] Endangered; CITES[3] protected; IUCN endangered	No direct data on hearing available. Sounds produced primarily in the 20 Hz to 10 kHz range.	Rare, seasonal migrant
Gray Whale *Eschrichtius robustus*	ESA (E. Pacific Population: non-threatened, W. Pacific Population: endangered) IUCN endangered, CITES protected	No hearing data available. Produces sounds from 15 Hz-20 kHz.	Uncommon, migrant and resident populations
Odontocetes			
Killer Whale *Orcinus orca*	IUCN-lower risk/ conservation dependent	Hears sounds from <0.5 kHz to 105 kHz. Produces sounds from 0.1 kHz to 85 kHz.	Uncommon in Puget Sound, common near San Juan Islands and Strait of Juan De Fuca, resident.
Harbor Porpoise *Phocena phocena*	IUCN – lower risk/conservation dependant	No data available.	Uncommon
Dall's Porpoise *Phocenoides dalli*	IUCN-lower risk/conservation dependant	No hearing data available. Produces sounds from 0.04 kHz to 160 kHz.	Uncommon, coastal resident
Phocids			
Harbor Seal *Phoca vitulina*	None	Hear sounds from 0.1 – 180 kHz. Vocalize at < 40 kHz.	Common resident in Puget Sound
Otariids			
Northern Fur Seal *Callorhinus ursinus*	None	No data available.	Uncommon, seasonal migrant
California Sea Lion *Zalophus californianus*	None	Most sensitive to sounds >1 kHz, can hear to <100 Hz.	Common resident and seasonal migrant
Steller Sea Lion *Eumetopias jubatus*	ESA Threatened	No data available.	Uncommon seasonal migrant

Source: Richardson et al. 1995; Croll et al. 1999; Department of the Navy 1999a; ROC, J. Calambokidis, Cascadia Research Cooperative; ROC, S. Jefferies, WDFW.

[1] *IUCN – International Union for Conservation of Nature and Natural Resources*
[2] *ESA – U.S. Endangered Species Act*
[3] *CITES – Convention on International Trade in Endangered Species*

33 tons (30 mt). Gray whales occur in both the eastern and western North Pacific Ocean and the Arctic Ocean.

The eastern north Pacific population migrates from breeding grounds along Baja California, Mexico to feeding areas in the Bering and Chukchi seas (Rice and Wolman 1971).

Some gray whales feed in more southern waters along the coasts of Mexico and California, Oregon, Washington, and British Columbia (Calambokidis et al. 1994).

Gray whales usually feed along the bottom in shallow waters close to shore. They often suck up big scoops of sediment and filter out the organisms with their baleen. Their primary prey is amphipod crustaceans but also includes polychaete worms, crab larvae, pelagic red crab, and small fish (Nerini 1984). Gray whale sightings are most common on the Washington coast, but they have been observed throughout Puget Sound including Hood Canal (Calambokidis et al. 1994). Gray whales occur in Puget Sound most frequently from March through May, which would be the eastern Pacific population. Gray whales have been sighted by range staff in and near the testing areas.

The eastern Pacific population of gray whales was listed as endangered under the ESA but was recently delisted. A recent review of the status of the eastern North Pacific stock (or California stock) by NMFS indicates that the population is growing at an annual rate of 2.5 percent and has an estimated population of 26,600 individuals. Because the population remains stable, the classification of the stock is to remain non-threatened with continued monitoring. The western North Pacific stock has not recovered and continues to be listed as endangered (64 FR 54275, October 6 1999).

Odontocetes

The odontocetes, or toothed whales, include 70 species of whales, porpoises, and dolphins. Their social systems range from solitary to complex family groups, such as exhibited by killer whales. The hearing range of at least some species range from 40 Hz – 150 kHz and is most sensitive in the middle frequencies of 10 – 100 kHz. Three species of odontocetes—the killer whale (*Orcinus orca*), harbor porpoise (*Phocena phocena*), and Dall's porpoise (*Phocenoides dalli*)—are found in Puget Sound with varying frequency. The harbor porpoise and Dall's porpoise are uncommon visitors to the inland waters of Hood Canal and Dabob Bay and are therefore excluded from the impact analysis.

Killer whales can grow to 30 feet (9.1 m) long and weigh 5 tons (4.5 mt); females are slightly smaller than males. Killer whales are found worldwide from about 80°N to 77°S (Department of the Navy 1999a; Angell and Balcomb 1982). They are most common in productive waters close to the coast (Mitchell 1975). Killer whales have a diverse diet and feed on fish, cephalopods, pinnipeds, sea otters, whales, dolphins, seabirds, and marine turtles. Several resident pods, or family groups, are found in Puget Sound and off the coasts of Washington and British Columbia. Several other transient pods occasionally visit the region. In southern British Columbia and northwestern Washington, killer whales spend more than 70 percent of their time in the upper 66 feet (20 m) of the water column but may dive to 660 feet

(201 m) (Baird et al. 1998). Killer whales enter Hood Canal and have been observed on one occasion in Dabob Bay by Navy staff from the Zelatched Point facility.

Pinnipeds

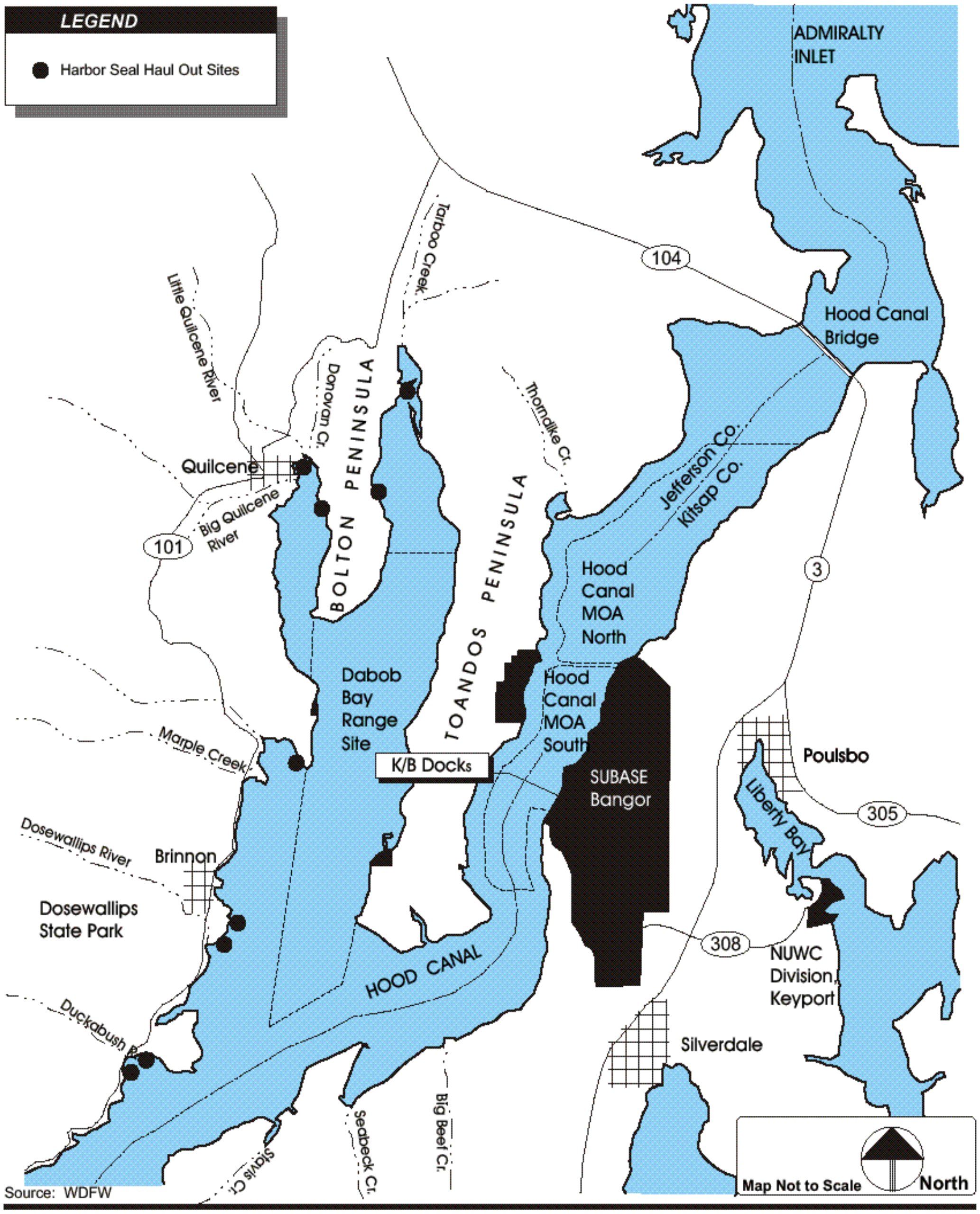
There are three families of marine mammals in the suborder Pinnipedia: (1) the Odobenidae, which is represented by the walrus; (2) the Phocidae, which are the true seals; and (3) the Otariidae, the eared seals, which include sea lions and fur seals. One member of the Phocidae, the harbor seal (*Phoca vitulina*), and three members of the Otariidae, the Steller sea lion (*Eumetopias jubatus*), the northern fur seal (*Callorhinus ursinus*), and the California sea lion (*Zalophus californianus*), occur in Puget Sound (Angell and Balcomb 1982). The Steller sea lion is federally listed as a threatened species and is discussed in Section 3.6. The fur seal is an uncommon visitor to the project area and is not included in the impact analysis.

Phocids

Harbor seals grow to about 6 feet (1.8 m) in length and weigh up to 230 lbs (105 kg). The harbor seal is the most common marine mammal in Puget Sound and in the Dabob Bay MOA. Numbers of harbor seals in Washington have increased by 7.7 percent annually between 1978 (when systematic counts began) and 1993 (NMFS 1999). The total estimated population in Washington is 34,134 seals (Huber 1995). Current estimates of the harbor seal population in Hood Canal range from 1,050 to 1,200 (NMFS 1999). Puget sound seals eat a variety of fish including black-belly eelpout (*Lycodopsis pacifica*), Pacific hake (*Merluccius productus*), staghorn sculpin (*Leptocottus armatus*), Pacific herring, pollock (*Theragra chalcogramma*), squid, molluscs, and crusteans (Angell and Balcomb 1982). Harbor seals can dive to about 300 feet (95 m) and remain submerged for up to 20 minutes. They commonly haul out at low tide to digest prey caught during the previous tide cycle. Harbor seals are easily disturbed from their haul-out sites and will scramble into the water if approached on foot or by a boat (Angell and Balcomb 1982). There are several harbor seal haul-out sites located in the Dabob Bay MOA (Figure 3.4-9).

Otariids

Male California sea lions grow to 6.6 feet (2 m) long and weigh 600 lbs (270 kg), while females are slightly smaller (Angell and Balcomb 1982). Subadult and adult lions will travel as far north as Bull Harbor on Vancouver Island during the winter, which is about 621 miles (1,000 km) north of the northernmost rookery at San Miguel Island, California. Over the last 15 years,counts of California sea lions at Everett, Washington (including Naval Station Everett) have increased from 108 individuals in 1979 (Everitt et al. 1980) to 1,113 in 1995 (NMFS 1996). In addition, up to 200 individuals



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Harbor Seal Haul Out Sites in Project Vicinity

Figure 3.4-9

observed to haul-out on docked submarines at SUBASE Bangor (ROC, James, 1999).

Other than Bangor, there are no documented sea lion haul-out sites in the project area. Sea lions are opportunistic feeders and prey upon locally abundant fish and cephalopods.

3.4.2 Environmental Consequences

3.4.2.1 Preferred Alternative

Marine Flora, Fish, and Invertebrates

No direct physical impacts to subtidal or intertidal fish habitats, or to habitats of marine flora or invertebrates would result from ongoing or future operations of the DBRC, since no new shoreline construction is proposed. In addition, all torpedo tests are conducted without warheads so there is no risk of explosion. However, seabed disturbance from torpedo recoveries in the deep waters of Dabob Bay may affect benthic infauna dwelling in the sediments such as polychaete worms and other invertebrates. The potential impacts to the environment from ongoing and future DBRC operations related to marine vegetation, fish, invertebrates, and marine mammals are discussed below in terms of specific hazards related to testing operations. Noise impacts are discussed in Section 3.7.

In discussing potential effects of MOA operations on marine finfish and salmonids, the following general notes apply: (1) information is limited about the presence and biology of the two lamprey species of concern in Hood Canal drainages, and about potential water quality and acoustic effects on lampreys in general; (2) coho, pink, and chum salmon and steelhead trout are all salmonid fish in the Family Salmonidae, with similar biology and life histories. Therefore, potential effects of ongoing and future operations of the Dabob Bay and Hood Canal MOAs on these four species of fish will be discussed together as potential effects on salmonids.

<u>Exhaust Releases</u>

There would be no adverse impacts to water quality (Section 3.1) from torpedo exhaust releases in test runs, as the distance traveled by the torpedoes effectively dilutes the concentrations of exhaust components to below water quality criteria, and therefore testing results in no effects to marine resources. Adverse impacts to water quality from exhaust releases during stationary tests or “exotic” rocket motor propulsion systems would be temporary in nature and limited to very small areas (a volume of water equal to that in a sphere with a radius of 7.74 ft [2.36 m] at most). In addition, stationary tests would be few in number. It is unlikely that fish would be present in the immediate vicinity of a stationary test; if present at the start of a test, they would most likely move to avoid the area due to the noise and exhaust produced. It is very unlikely that fish would remain inside the volume of water surrounding the test vehicle where elevated concentrations of toxic compounds are present for a long enough time for adverse effects to develop. It is possible that concentrations of carbon monoxide may be temporarily high enough to cause adverse effects in fish, if present in the immediate vicinity of the stationary test. However, fish would be unlikely to remain in the area with elevated levels long enough to be affected. Water quality samples collected by the Battelle MSL on the surface and off the bottom of Dabob Bay on the DBRC test range indicate that analyzed metals (Cd, Cu, Pb, Zn, Li, and Zr) are not present at elevated levels (Crecelius 2001). Metal concentrations are comparable to background levels present in non-urban portions of Puget Sound, and are either well below Washington State water quality criteria (Cd, Cu, Pb and Zn) for the protection of aquatic life, at naturally occurring levels (Li) or are well below levels considered toxic to aquatic organisms (Zr).

Accidental Fuel Oil and Propellant Spills

No intentional releases of fuel oil or torpedo propellant would occur, and the Navy has a zero discharge policy of fuel and other hazardous substances, which is designed to eliminate or reduce the chance of spills during operations at sea.

As discussed above in Section 3.1, it is unlikely that marine resources would be significantly affected by accidental releases of torpedo propellant or other hazardous substances, except in the unlikely event of a complete torpedo rupture or major fuel oil spill. Response actions taken under Navy contingency plans would reduce the potential impacts of such a spill.

Increased Turbidity from Seabed Disturbance

Temporary and local turbidity increases from torpedo retrieval are not expected to adversely affect marine flora and fauna as the great majority of these recoveries are in the deep waters of Dabob Bay (up to 600 feet [183 m] deep). These depths are far below waters utilized by most fish or marine mammals at any life stage or time. Even if a recovery were to occur in shallow, nearshore areas temporarily inhabited by salmonid juveniles or adults, other marine finfish, or in deep waters inhabited by demersal finfish, any increased turbidity in the water column would be: (1) short lived in nature, and (2) easily avoidable by the fish. Salmon have been shown to avoid turbid waters in a number of studies (Bisson and Bilby 1982; Whitman et al. 1982).

Disturbance of the seabed during recovery operations for torpedoes and other devices would almost all be limited to deep waters of Dabob Bay or northern Hood Canal below the photic zone and any existing macroalgal and eelgrass habitats. It is possible that very rarely a torpedo or underwater device would have to be recovered from an area supporting macroalgae or eelgrass. Even if a recovery were to occur in such a habitat, any disturbance would be short-term and small in size, with relatively quick recovery.

Benthic infauna communities, including non-commercial bivalves living in deep water sediments, could be affected by seabed disturbance during recovery operations. No geoduck clams are present in the deepest waters (600 feet) of Dabob Bay, as the lower limit of their abundance is 360 feet (110 m) (Goodwin 1973). Given that recoveries are rare events and the size of the area disturbed would be relatively small, impacts would not be significant. In addition, many of the disturbed benthic invertebrates would likely actively re-bury in the sediments and/or re-colonize the affected area within a relatively short time, as the disturbed sediments are not removed, only re-distributed in the same location. Benthic invertebrate colonization of new, unpopulated sediments placed on the sea floor ranged from 19 to 33 weeks in a shallow (26 feet [8 m] deep) urban harbor to 11 months in a deep water basin (4,068 feet [1,240 m] deep) (Diaz-Castaneda et al. 1989; Kukert and Smith 1992).

Heavy Metal Leaching into Sediments and the Water Column

Potentially, heavy metals could leach from lead anchors, aluminum parachute weights, and/or ends of coated copper core guidance wire used in the course of DBRC operations. These potential sources of water and sediment quality degradation are very unlikely to adversely affect salmonids of any life stage, or forage fish and most other marine finfish. This is due primarily to the fact that any potential heavy metal leaching would most likely take place in the deep waters of Dabob Bay and Hood Canal, away from areas frequented by salmonids and most finfish.

Any leached lead, copper, cadmium, aluminum, or other heavy metals from these sources are likely to be adsorbed onto anaerobic bottom sediments present at the surface and below the upper few (1-2) cm of sediment in Dabob Bay and Hood Canal, and to not be released to the water column (Song and Muller 1999; PSEP 1991; D'Itri 1990). This reduces or eliminates the possibility that the heavy metals would be bio-available to plants or marine organisms, although benthic invertebrates may be reduced in number due to exposure to heavy metals if immediately adjacent to similar anchors or weights in the upper few (1-2) cm of the sediments which are oxidized. Benthic invertebrate abundance was not reduced at the two stations (#14 and 15) sampled in northern Hood Canal and Dabob Bay (Striplin et al. 1991). In addition, any unrecovered anchors and guidance wire would sink into the soft-bottom sediments in deep water, and would also be subject to sedimentation processes over time. All of these processes would reduce or eliminate the possibility of exposing demersal finfish and benthic invertebrates to lead and/or copper in lost anchors and guidance wire. In addition, laboratory analysis of surface sediment samples collected by the Battelle MSL on the bottom of Dabob Bay on the DBRC test range indicate that analyzed metals (Cd, Cu, Pb, Zn, Li, and Zr) are not present at elevated levels (Crecelius 2001). Metal concentrations observed are at low levels comparable to background levels present in other muddy, non-urban bays in Puget Sound. These concentrations are either well below Washington State sediment quality standards (Cd, Cu, Pb and Zn) or are at naturally occurring levels seen in sedimentary rock (Li and Zr).

Electromagnetic Tests

Testing of systems that generate an electromagnetic field (EMF) occurs only about 10 times per year. The EMF generated by the test is weak and attenuates rapidly. The EMF at a distance of 3.3 ft (1 m) from the source would be about 0.137 mG. Distribution lines for electricity produce magnetic fields that are about 5 mG while background magnetic fields in homes averages about 2.9 mG (National Research Council 1998). The limited use of this system in the DBRC is expected to have no effects on marine organisms.

Essential Fish Habitat Species

Based on the above information, there would be no significant impacts to individuals or the 'essential fish habitat' of the groundfish (listed in Table 3.4-1) present in Dabob Bay and/or northern Hood Canal. National Marine Fisheries Service (NMFS) concurred with this determination in a letter dated 7 June 2001.

Marine Mammals

Marine mammals are protected from "taking" under the federal Marine Mammal Protection Act (MMPA) of 1972 within the United States, its territories, or on the high seas. The MMPA thresholds, as defined below, are used as the thresholds for level of significance. Taking is defined as "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." The term harassment is defined under the MMPA as any act of pursuit, torment, or annoyance that has the potential to:

- Injure a marine mammal or marine mammal stock in the wild; or
- Disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

The MMPA defines two levels of harassment. Level A Harassment involves non-serious injury to an animal. Level B Harassment involves non-injurious harassment of an animal. Cetaceans and most pinnipeds are the responsibility of the NMFS, while walruses, polar bears, sea otters, and sirenians are under the jurisdiction of the USFWS. Regulations published to implement the MMPA indicate that for cetaceans and seals taking includes "the negligent or intentional operation of an aircraft or vessel, or the doing of any other negligent or intentional act which results in the disturbing or molesting a marine mammal" (50 CFR 216.3). An action that results in any change in behavior attributable to human activity may be considered a "take by harassment," depending on the circumstances. Some marine mammals are also protected under the federal ESA. Section 3 of the ESA defines "take" as to harass, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct to species listed as threatened or endangered in 50 CFR 402.12. The USFWS further defines “harm” as “significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering,” and “harass” as “actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering” (NMFS and USFWS 1994). Therefore, any take of a marine mammal by DBRC actions caused through harm or harassment is considered a significant impact. A separate Biological Assessment (see Appendix C) has been prepared and forwarded to NMFS and USFWS and is summarized in Section 3.6.

A report by the International Union for Conservation of Nature and Natural Resources (IUCN) (Reeves and Leatherwood 1994) documents threats to cetaceans, including hunting, incidental capture in fishing nets, pollution, and habitat loss and degradation. Many marine mammals are also protected under the Convention on International Trade in Endangered Species (CITES).

There are four general categories of potential effects to marine mammals from operations included in the OMP: (1) torpedo hazards, (2) collision hazards, (3) disturbance from underwater noise, (4) and entanglement. Noise impacts are discussed in Section 3.7. The marine mammal species most likely to occur in the Dabob Bay MOA are the harbor seal and the California sea lion, while the gray whale and the killer whale are occasional visitors to Hood Canal (Table 3.4-6). Gray and killer whales have been observed in Dabob Bay. The analysis of potential effects will include these four species. The Steller sea lion is discussed in Section 3.6, Endangered Species.

<u>Torpedo Hazards</u>

Some test torpedoes trail thin guidance wires as they travel from one end of the range to the other. These wires fall to the bottom substrate, composed of mud and organic ooze. Guidance wire sizes are 26-gauge copper for heavyweight guide wires and 240 microns for fiber optic cable. Copper wire has a low breaking strength of 30-foot lbs (4.15 m/kg). Marine mammals do not frequent the bottom of Dabob Bay, which ranges from 375-600 feet (114-183 m); once the guidance wires settle on the bottom they pose no entanglement threat. In addition, the Navy’s operating procedure is to conduct surveys before each test and postpone tests if marine mammals, other than harbor seals, are spotted in the project area (also see Section 2.3.4). If harbor seals are present within 100 yards (91 m) of the expected system path the test will be postponed. The abundance of harbor seals in the DBRC has lead to this operating procedure. These protocols are included in the Range Operating Procedures (ROP). Navy range operators at Dabob Bay routinely receive training as marine mammal observers. While gray whales often feed in Puget Sound by sifting bottom sediments, they feed in shallow areas near the shoreline (Calambokidis et al. 1994) and would not be affected by guidance wires.

Lightweight torpedoes launched from the air use a small parachute to slow their entry into the water. The parachute detaches from the torpedo and slowly drifts to the bottom of the bay. Air launches are conducted approximately 10 times per year. If large marine mammals, such as whales or sea lions, were in the vicinity they could become entangled in the parachute cord. Because tests are not conducted if large marine mammals are in the vicinity, there is no risk to whales or sea lions. However, because of the number of resident harbor seals that use the DBRC, a test is postponed only if a harbor seal is within 100 yards (91 m) of the line of travel of a test vehicle. The 100-yard (91 m) buffer affords some protection for harbor seals against any entanglement hazard, but it is possible that a harbor seal could enter the area while a parachute is in the water column. Unlike the guidance wires, which break easily, the parachute cord has a high tensile strength. The parachute is not released until after the torpedo enters the water and its engine starts. The noise from the torpedo entering the water and the engine starting should further deter seals from venturing close to the parachute. Therefore, there is a low level of risk that a harbor seal could become entangled as a parachute slowly drifts to the seafloor during the approximately 10 times per year that air launches are conducted. While some test activity may temporarily alter the use of portions of the DBRC by harbor seals, this behavior modification does not reach the level of "take by harassment", and is not a significant impact. (66 FR 22452-22453, 4 May 2001) Once a test is complete (1-2 hours) harbor seal use of the test area would resume.

Test torpedoes use a variety of propulsion systems, including internal combustion engines, chemical energy propulsion, electrical propulsion, and limited experimental thermal propulsion. A release of chemical or fuel pollutants by malfunctioning torpedoes could harm any marine mammals in the immediate vicinity. This risk is highest for impact tests of torpedoes, where the torpedo strikes a target. A torpedo could fracture its outer and inner casing on impact with a target, releasing fuel into the water. Most tests do not include target impact, and fewer than 10 impact tests are conducted per year involving lightweight torpedo units. Historically the rupture rate has been about 1 percent. The risks to marine mammals from such an event are negligible because of the infrequency of the occurrence in combination with surveys conducted prior to tests, and the rapid dispersion into the water column of torpedo pollutant releases.

Tests that include an EMF field are conducted only about 10 times per year. The electromagnetic field is relatively weak (see Section 2.3.3.2), and those tests conducted at depth would have no effect to the marine fauna of the DBRC. The EMF generated by the test is weak and attenuates rapidly. The EMF at a distance of 3.3 ft (1 m) from the source would be about 0.137 mG. Distribution lines for electricity produce magnetic fields that are about 5 mG while background magnetic fields in homes averages about 2.9 mG (National

Research Council 1998). The limited use of this system in the DBRC is expected to have no effects to marine mammals.

In addition, marine mammal surveys are conducted prior to all DBRC tests to ensure that no large marine mammals are in the vicinity and that no harbor seals are within 100 yds (33 m) of the test area. Tests that include trailing an EMF field at the water's surface may emit some EMF field into the atmosphere, but this is expected to be minimal.

Collision Hazards

The large marine mammals that may occur in the project area, gray whales and killer whales, are more susceptible to collisions with boats or test torpedoes than the smaller, more maneuverable seals and sea lions. Surveys for marine mammals are conducted prior to each test, and tests are postponed if a marine mammal, other than harbor seals, is observed in the vicinity. If harbor seals are present within 100 yards (91 m) of the expected system path the test will be postponed. The abundance of harbor seals in the DBRC has led to this operating procedure. Tests are not resumed until the marine mammal is confirmed to have left the vicinity. NMFS, which administers the MMPA for those species that may occur in the DBRC, recommends that vessels not intentionally approach within 100 yards (91 m) of marine mammals (NMFS undated). All Navy vessels comply with this directive. It is highly unlikely that a whale could enter the project undetected during a test. Therefore, collision between a boat or test torpedo and a gray whale or killer whale is not likely to occur. Therefore, the only potential effect from the Preferred Alternative to marine mammals is the minor risk that a harbor seal would enter the test area after an aircraft-launched torpedo has released its parachute. A seal could become entangled if it were to investigate the slowly sinking parachute. Such an event would be defined as "injury" under the MMPA. Because such tests are conducted only 10 times per year and the chance of a seal encountering a parachute is low, this potential threat is negligible.

3.4.2.2 Dabob Bay Limited Alternative

Environmental impacts would be the same as for the Preferred Alternative, with the difference that they would be geographically concentrated within the Dabob Bay MOA. Testing that would shift to Dabob Bay from Hood Canal is relatively non-intrusive and would add only negligible effects above those described for the Preferred Alternative. No range testing or proofing operations covered by this EA would occur in Hood Canal under this alternative, eliminating the opportunity for even minor impacts to marine flora or fauna in the Hood Canal area.

3.4.2.3 No Action Alternative

Environmental impacts to marine flora and fauna would be similar in type as for the Preferred Alternative. Environmental impacts of tests would need to be established by individual testing programs with NUWC Division Keyport. Quantity and type of tests may vary widely from events described in the Preferred Alternative, as impacts would depend on test program parameters established for each independent program.

3.4.3 Mitigation Measures

No significant impacts are anticipated to marine flora and fauna. Therefore, no mitigation measures are proposed or required.

3.5 TERRESTRIAL FLORA AND FAUNA

This section addresses impact to natural communities and terrestrial wildlife populations, including birds. Analysis below shows that the Navy is in compliance with local and federal regulations for these areas.

3.5.1 Affected Environment

The terrestrial environment of the Dabob Bay project area is characterized by a rural landscape and second-growth forest. These forests are dominated by Douglas-fir (*Pseudostuga menziesii*), western red cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), red alder (*Alnus rubra*), and big-leaf maple (*Acer macrophyllum*). Typical understory species include Indian plum (*Oemleria cerasiformis*), red elderberry (*Sambucus racemosa*), vine maple (*Acer circinatum*), Oregon grape (*Mahonia* spp.), and swordfern (*Polystichum munitum*). The shoreline of the project area consists of coarse sand and cobble on the upper part of the beach and fine unconsolidated material in the intertidal zone.

The second-growth forests of the vicinity support a variety of wildlife species. Common bird species that occur in the project area include winter wren (*Troglodytes troglodytes*), black-capped chickadee (*Parus atricapillus*), ruby-crowned kinglet (*Regulus calendula*), MacGillivray's warbler (*Oporornis tolmiei*), yellow-rumped warbler (*Dendroica coronata*), varied thrush (*Ixoreus naevius*), and song sparrow (*Melospiza melodia*). The WDFW Priority Habitat and Species Database (PHS) indicates that a historic great blue heron (*Ardea herodias*) rookery is located about 1,000 feet (305 m) southeast of the dock at Zelatched Point, adjacent to the south side of a small wetland complex. This rookery is not currently occupied although it was used in the late 1980s (ROC, Sherato, 2000). In addition, the PHS database has records for an osprey (*Pandion Haliaetus*) nest about 300 feet (91 m) south of the dock at Zelatched Point on a steep, north-facing hillslope. This osprey nest has been active for at least several years, but WDFW does not monitor osprey nests because they are not a priority species; no further data are available for this nest (ROC, Sherato, 2000). Several other osprey nests are known to occur within ¼ mile (0.4 km) of the shoreline along other areas of Dabob Bay and Hood Canal.

Ecologically important intertidal estuarine wetlands occur at the head of Quilcene Bay where the Big Quilcene River, Little Quilcene River, and Donavan Creek flow into the bay. Another large intertidal estuarine wetland occurs at the head of Dabob Bay at the Tarboo Creek confluence and on the north side of Hood Canal at the Thorndike Creek confluence. A variety of wildlife feed in these estuaries including white-winged scoters (*Melanitta deglandi*), buffleheads (*Bucephala albeola*), double-crested cormorant (*Phalacrocorax auritus*), great blue heron, river otter (*Lutra canadensis*), and raccoon (*Procyon lotor*). These estuarine wetlands are also used by harbor seals as haul-out sites during low tide (see Section 3.4).

A 2-acre (0.8 ha) freshwater wetland occurs on a flat bench east of the Zelatched Point Road near the wharf (see Figure 2.2-3). The wetland is formed from the outflow of an unnamed creek that flows from the adjacent hillslope. No stormwater from any project facilities flows directly into the wetland. The north end of the wetland drains via a narrow channel to Dabob Bay. This wetland, and others found in the project area, probably support common amphibians including red-legged frog (*Rana aurora*), northwestern salamander (*Ambystoma gracile*), long-toed salamander (*A. macrodactylum*), western red-backed salamander (*Plethodon vehiculum*), and Pacific chorus frog (*Pseudacris regilla*). Reptiles likely to occur in the project area include common garter snake (*Thamnophis sirtalis*), western fence lizard (*Sceloporus occidentalis*), and western skink *(Eumeces skiltonianus*).

3.5.2 Environmental Consequences

3.5.2.1 Preferred Alternative

No new land-based facilities or construction activities are planned as part of the Proposed Action, and any habitat manipulation would be limited to minor vegetation clearing associated with maintenance around the Zelatched Point facilities. There are no plans to upgrade the existing wharf or access road, and there would be no effects to estuarine or freshwater wetlands in the project area.

Fixed-wing aircraft used in Navy tests are primarily P-3s; launch helicopters are SH-60s; and recovery helicopters are Hughes 500s, or equivalent. General flight rules for helicopters and fixed-wing aircraft include:

- Flights over land must be at a minimum elevation of 1,000 ft (305 m);
- Flights over water must be at a minimum elevation of 500 ft (152 m);
- Flights must maintain a 656-foot (200 m) lateral no-fly buffer around the bald eagle nests; and

- Flights within 500 yards (457 m) of the shoreline must be at a minimum elevation of 1,000 ft (305 m).

Helicopters fly as low as 50 feet (15.2 m) when launching or recovering torpedoes from the water and to set the recovered torpedo at the helicopter pad at Zelatched Point. The fixed wing aircraft fly at higher elevations. Estimates for future operations include 10 fixed-wing aircraft torpedo or helicopter launches per year, and 10-20 helicopter recoveries per year. Some of these operations have the potential to disturb species that nest in the upper portions of large trees and near the shoreline of the Dabob Bay MOA. Nesting raptors, particularly osprey, nesting near the shoreline and heron rookeries are probably the most susceptible species. The most likely point of disturbance would be at Zelatched Point where retrieval helicopters must approach the shoreline to place recovered torpedoes on the heli-pad. Potential effects to bald eagles (*Haliaeetus leucocephalus*) and marbled murrelets (*Brachyramphus marmoratus*) are documented in a separate Biological Assessment (see Appendix C) and are summarized in Section 3.6.

The documented heron rookery at Zelatched Point is about 1,000 feet (305 m) from the heli-pad, on the opposite side of the freshwater wetland. The rookery is screened from the Zelatched Point facilities by dense, second-growth forest. If this rookery is re-occupied, it is unlikely that it would be affected by helicopter landings and take-offs that have been part of the ongoing operations in Dabob Bay because of the distance from the disturbance and the vegetative screening.

The osprey nest at Zelatched Point is at the top of a large Douglas-fir snag, about 300 feet (91 m) from the heli-pad. Because the nest tree is located upslope from the beach, ospreys have a clear line of sight to the heli-pad. Although the WDFW has no productivity data for this nest from its size it appears to have been used for at least several years. It appears that osprey that use this nest are acclimated to the occasional helicopter landings nearby; given the estimated level of use over the next several years, no effects are anticipated**.**

3.5.2.2 Dabob Bay Limited Alternative

Environmental impacts would be the same as for the Preferred Alternative, with the difference that they would be geographically concentrated within the Dabob Bay MOA. No range testing or proofing operations addressed in the OMP or this assessment would occur in Hood Canal under this alternative, eliminating the opportunity for even minor impacts to vegetation and wildlife resources in the Hood Canal area. This alternative has the potential to increase transient impacts to individual species using the waters or near shore environment of Dabob Bay, such white-winged scoters and buffleheads. Tests that would be transferred from Hood Canal to Dabob Bay are relatively non-intrusive and would result in a negligible increase in effects as described in the Preferred Alternative.

3.5.2.3 No Action Alternative

Environmental impacts would be similar in type as for the Preferred Alternative. Environmental impacts of tests would need to be established by individual testing programs with NUWC Division Keyport. Quantity and type of tests may vary widely from events described in the Preferred Alternative, as impacts would depend on test program parameters established for each independent program.

3.5.3 Mitigation Measures

As no significant effects to terrestrial resources are anticipated under the Proposed Action, no mitigation measures are required or proposed.

3.6 THREATENED AND ENDANGERED SPECIES

Details on the occurrence of the species in the project area listed as threatened or endangered under the federal Endangered Species Act are in a separate Biological Assessment (EDAW 2001) prepared for the project. This document is incorporated herein by reference and can be found in Appendix C. Threatened and endangered species occurrence and potential effects are summarized below. The analysis below shows that the Navy is in compliance with federal regulations for each of these areas.

3.6.1 Affected Environment

Federally designated threatened or endangered wildlife species potentially occurring in the project area include the Puget Sound chinook salmon, Hood Canal summer-run chum salmon, coastal Puget Sound bull trout (*Salvelinus confluentus*), humpback whale, Steller sea lion, marbled murrelet, and bald eagle. Chinook salmon, summer-run chum salmon, and bull trout all reproduce in streams and rivers emptying into Dabob Bay and Hood Canal, and are present in the DBRC in various life stages at different times of the year.

Hood Canal summer-run chum salmon stocks have been historically found in the Big and Little Quilcene Rivers, the Dosewallips, Duckabush, Hamma Hamma, Skokomish, Union, Tahuya, Dewatto and Union Rivers. Smaller streams historically supporting summer-run chum salmon include Coulter, Rocky, Big Beef, Anderson, and John Creeks. Recent analysis indicates that summer-run chum stocks have been extirpated in the Dewatto and Tahuya Rivers, and in Big Beef and Anderson Creeks (Tynan, 1997). In addition, the Skokomish River is not considered to have a viable run of summer-run chum, with only incidental fish reported.

Puget Sound chinook salmon runs in Hood Canal are primarily associated with larger rivers in the region where preferred higher flows and larger spawning gravel are found, as opposed to smaller rivers and streams (Williams et al., 1975). Two spawning run types of chinook salmon exist in the Hood Canal watershed: summer/fall and spring runs. Rivers with summer/fall-run chinook include the Big Quilcene, Dosewallips, Duckabush, Hamma Hamma, Skokomish, Union, Tahuya and Dewatto Rivers. Williams et al. (1975) identifies spring-run chinook stocks in the Dosewallips and Duckabush Rivers and states that a spring-run was formerly found in the Skokomish River. Summer/fall-run stocks return to spawn and begin upstream migration in Hood Canal rivers from mid-July through the end of October and spawn from late August through mid-November. Spring-run stocks return from mid-May through late August, and spawn from mid-July through early October.

Coastal / Puget Sound bull trout (*Salvelius confluentus*) are char in the family Salmonidae native to the Pacific Northwest and western Canada (63 FR 31693; June 10, 1998). Bull trout inhabit cold, freshwater streams and rivers (which remain primarily less than 15^{o} C) their entire lives, with some evidence for the existence of an anadromous, sea-going form, although this is considered uncertain (McPhail and Baxter, 1996). In Hood Canal, three separate stocks of bull trout occur in the Skokomish River watershed (Mongillo, 1993; WDFW, 1998). Although two bull trout were observed in the past on the Big Quilcene River, which flows into Dabob Bay, no bull trout have been seen since. Thus, it is not believed that a distinct Big Quilcene River population of bull trout exists. Two of the Skokomish River stocks of bull trout are landlocked on the North Fork of the river. One stock is in the Lake Cushman Reservoir, and is considered ‘healthy’. The other stock is above the Staircase waterfalls on the upper North Fork Skokomish. The status of this population is unknown. The third stock is on the South Fork Skokomish River. The status of this stock is unknown, but it may include an anadromous population.

Humpbacks are primarily a coastal species that travel over deep pelagic waters migrating between high latitude feeding areas in Alaska and low latitude breeding grounds in Hawaii or Mexico (Department of the Navy 1999a). While the species was once common in Puget Sound, humpback whales are now only occasional visitors (Everitt et al. 1980). Every one to two years, a humpback whale is sighted in Puget Sound, even as far south as Budd Inlet near Olympia, but these visits to inland water are unusual (ROC, Calambokidis, 1999). Results of monitoring the movements of a humpback whale in Puget Sound during 1988 showed that this individual traveled as far south as Olympia, but no sightings were reported within Hood Canal or Dabob Bay (Calambokidis and Steiger 1990). Humpbacks produce a variety of sounds in the range of 20 Hz to 10 kHz with an effective range of about 6.2 – 12.4 miles (10 – 20 km) (Department of the Navy 1999a). Source levels range from 144 to 174 dB and their songs can be detected by hydrophone at distances up to 9.3 miles (15 km) (Richardson et al. 1995). Data on the hearing ability of humpbacks, as for most whales, is lacking; because their communication is low frequency (LF), however, it is assumed that they have excellent LF hearing.

Steller sea lions generally move into Puget Sound in the fall; by midwinter they may number several hundred (Angel and Balcomb 1982). They have been known to frequent Sucia Island, Race Rocks off southern Vancouver Island, and Sombrio Point in the northern sound but are rare south of Admiralty Inlet (Yates 1988). During El Niño years, Steller sea lions have been observed using Fox Island as a haulout, which is near Tacoma (ROC, Jeffries, 1999). Small groups (3-5 individuals) of Steller sea lions are observed in Hood Canal during a five-week period during late winter/early spring (ROC, James, 1999) before moving north to breeding sites. There are no Steller sea lion breeding sites in Puget Sound. There are no data available about the underwater hearing and sound production in Steller sea lions, but they do produce a variety of clicks and growls (Department of the Navy 1999a).

3.6.1.1 Bald Eagle and Marbled Murrelet

Bald eagles are currently listed as threatened in Washington but have been proposed for delisting. While bald eagles are expected to be delisted within the next year, their numbers will continue to be monitored as part of the delisting process, and they will still be protected under the Federal Bald and Golden Eagle Protection Act. Breeding and wintering bald eagles are commonly found along the Puget Sound coastline. Nests are built in dominant trees, primarily Douglas-fir in Puget Sound, within 656 feet (200 m) of open water. Bald eagle territories average 0.4-0.8 square miles (1-2 km^2) (Stalmaster 1987) but may be as large as 3.1 square miles (8 km^2) in Washington (Grubb 1976). During the winter, bald eagles often congregate in communal roosts during the evening. These sites are chosen for favorable microclimates that protect eagles from harsh weather (Stalmaster 1987).

Twenty-five bald eagle nesting territories have been identified in the Dabob Bay project area (WDFW 1999c). In addition, the WDFW has identified two communal roosts in the vicinity. One is located up the Big Quilcene River valley (exact location unknown) and the second is located north of Pulali Point, which is on the west side of Dabob Bay. Both communal roosts are inland and away from all Navy activity on Dabob Bay.

Marbled murrelets, a threatened species under the ESA, are small sea birds that range from southeast Alaska to Santa Cruz in northern California. Unlike other seabirds that nest in ground burrows, it is the only alcid that nests in trees. Marbled murrelets are closely associated with old-growth conifer stands and trees that are 150+ years and >35 inches (89 cm) diameter at breast height (dbh) (Binford et al. 1975; Carter and Sealy 1987). The nesting season extends from April 1 to September 15. The WDFW has mapped several marbled murrelet breeding areas west of Highway 101 in the Big Quilcene River basin. Documented breeding sites are no closer than 2.5 miles (4 km) of the Dabob Bay shoreline.

Marbled murrelets feed in Puget Sound throughout the year, with larger concentrations in limited areas during the fall and winter. These birds feed within 1.2 miles (2 km) of shore and dive for sand lances (*Ammodytes hexapterus*), sea perch (*Embiotoca lateralis*), other small schooling fish, and crustaceans. Open waters of entrance channels off rocky shores or over reefs are important feeding locations (Angel and Balcomb 1982). Surveys conducted along Hood Canal (Sustainable Ecosystems Institute 1997) indicate that numbers of marbled murrelets increased from 200 to 400 from October through November. Distribution of birds varied throughout the season, and most marbled murrelets were observed within 1,640 feet (500 m) of shore.

3.6.1.2 Northern Spotted Owl

Northern spotted owls, listed as a threatened species under the ESA, are found in the Pacific coastal region from British Columbia to Marin County, California. Abundant research indicates that spotted owls are strongly associated with late successional and old-growth forests. The spotted owl occurs in areas within most of its historic range, but its distribution has been altered from long-term effects of habitat removal and alteration. Nesting occurs in mature and old-growth stands that contain a high degree of structural complexity. Roosting habitat is similar to nesting habitat. Younger forest types may be used where the structural attributes of older forests are present (Washington Department of Natural Resources [WDNR] 1997).

A circular management zone (2.7-mile [4.3 km] radius) has been set by the USFWS around known spotted owl nests that restricts certain land use practices. WDFW Priority Habitat and Species (PHS) data indicate the occurrence of several spotted owl management circles west of Quilcene Bay. Two management circles extend into Quilcene Bay where it joins Dabob Bay; one of these extends across Quilcene Bay onto the western shoreline of the Bolton Peninsula between Quilcene Bay and Dabob Bay. No spotted owl breeding locations were identified on the Toandos Peninsula.

3.6.2 Environmental Consequences

3.6.2.1 Preferred Alternative

There would be no adverse impacts to water quality, and thus to threatened salmonids, from torpedo exhaust releases in test runs, as the distances traveled by the torpedoes effectively dilute the concentrations of exhaust compounds to below water quality criteria and levels causing toxic effects. Potential adverse impacts to water quality and salmonids from exhaust releases during stationary tests of the “exotic” rocket motor propulsion system would be temporary in nature (tests are only 10 seconds long) and limited to very small areas. In addition, stationary tests of this system would only take place twice a year on average. It is unlikely that salmonids would be present in the immediate vicinity of a stationary test; if present at the start of a text, they would actively move to avoid the area due to the noise and exhaust produced.

In addition, it is very unlikely that salmonids would remain inside the volume of water surrounding the test vehicle where elevated concentrations of toxic compounds were present for a long enough time for adverse effects to develop. It is possible that concentrations of carbon monoxide may be temporarily high enough to cause adverse effects in salmonids, if present in the immediate vicinity of the stationary test. However, the fish would be unlikely to remain in the area with elevated levels long enough to be affected.

Water quality samples collected by the Battelle MSL on the surface and off the bottom of Dabob Bay on the DBRC test range indicate that analyzed metals (Cd, Cu, Pb, Zn, Li, and Zr) are not present at elevated levels (Crecelius 2001). Metal concentrations are comparable to background levels present in non-urban portions of Puget Sound, and are either well below Washington State water quality criteria (Cd, Cu, Pb and Zn) for the protection of aquatic life, at naturally occurring levels (Li) or are well below levels considered toxic to aquatic organisms (Zr). Thus, threatened salmonids would not be exposed to or adversely impacted by these potential contaminants.

It is unlikely that threatened salmonids would be in the vicinity of a complete torpedo impact rupture at the few times they occur. In addition, some of these incidents may be at water depths not utilized by salmonids. As the probability of accidental fuel oil or torpedo propellant spills is very low during routine DBRC operations, it is unlikely that salmonids would be significantly affected except in the event of a major fuel spill. Response actions taken under Navy contingency plans would reduce the potential impacts of such a spill.

Temporary increases in turbidity arising from recovery of buried torpedo and other devices are not expected to adversely affect threatened salmonids, as the great majority of these recoveries are in the deep waters of Dabob Bay (up to 600 feet [183 m] deep), far below waters utilized by salmon at any life stage or time. In addition, recoveries of buried torpedoes or other devices are rare, occurring about 7 times per year. Even if a recovery were to occur in a shallow, nearshore area temporarily inhabited by salmonid juveniles or adults, any increased turbidity in the water column would be: (1) short lived in nature, and (2) easily avoidable by the fish. Salmon have been shown to avoid turbid waters in a number of studies (Bisson and Bilby 1982; Whitman et al. 1982).

Potential heavy metal leaching from anchors, guidance wire, and other devices lost on the bottom of Dabob Bay or Hood Canal would be very unlikely to adversely affect threatened salmonids of any life stage. This is due primarily to the fact that any potential heavy metal leaching would most likely take place in the deep waters of Dabob Bay and Hood Canal, far below depths utilized by salmonids.

Salmonids only perceive and elicit avoidance responses to low frequency sounds up to 800 Hz, with greatest sensitivity to sounds below 150 Hz, sounds which are only infrequently generated in DBRC operations. These species are unable to perceive high frequency sounds such as the 75 kHz tracking "pingers" used most often in DBRC operations. Salmonids only react to low frequency sounds, and then only at distances within a few meters of the sound source, possibly because they are reacting to water particle motion/ acceleration rather than sound pressure as such. Should salmonid fish in the DBRC find themselves within a few meters of low frequency sound sources emitting from a surface ship, submarine, or countermeasure device, the fish would react by swimming beyond a few meter radius from the sound source, with no harm inflicted (Carlson 1994).

The Navy has developed and implemented procedures to survey for marine mammals in the project area prior to all testing. If a threatened or endangered marine mammal is observed in the test vicinity, the test is postponed until the animal is confirmed to leave the project area. Humpback whale response to boats varies from curiously approaching boats to avoidance of boats. Humpbacks have been documented to change course to apparently avoid a ship several kilometers away, while feeding humpbacks were not disturbed by a large tanker ship that passed within 2,600 feet (792 m). Humpback whales also have shown some apparent avoidance responses and cessation of songs in response to LF sonar ranging from 120 to 150 dB (Richardson et al. 1995). Humpbacks showed no response to acoustic pingers in the 27-30 kHz range (Goodyear 1993). Navy tests of LF sonar impacts on marine mammals also indicate some temporary avoidance and disruption of humpback whale songs to LF sounds in the range of 120 – 150dB. It appears that there is some disturbance to humpbacks from LF noise that is 120 dB or higher, though the extent of disturbance appears to be mild and often temporary (Department of the Navy 1999a). However, this does not reach the threshold of harm or harassment in the MMPA nor is it a significant impact as currently discussed by NMFS in their response to comments for USS CHURCHILL Incidental Take Permit (66 FR 22452-22453).

It is therefore not likely the noise of the TOSS and fleet sonar could cause any humpback whales in the vicinity of Dabob Bay during a test to avoid the area. This risk is negligible because humpback whales rarely enter Puget Sound, have not been reported in Dabob Bay, and because marine mammal surveys are conducted prior to each test to ensure no endangered marine mammals are in the vicinity.

Some test torpedoes trail thin (1 mm) guidance wires as they travel from one end of the range to the other. These wires fall to the bottom substrate, which is composed of mud and organic ooze. These wires could cause some entanglement threat to marine mammals that may be in the area for the short time the wires are in the water column. Humpback whales would be most at risk if they encountered these wires because of their large size and large pectoral flippers. In the unlikely event that a whale did enter the bay during a test and snared a torpedo wire, the wire would probably break, however, because of its small diameter. Guidance wire sizes are 26 gauge for heavyweight guide wires and 240 microns for fiber optic cable. Lightweight torpedoes that are launched from aircraft use a parachute that detaches and slowly sinks to the sea floor. Parachute cord is stronger than the guidance wire and poses a greater threat for entanglement. The aircraft launches are conducted only about 10 times per year. In addition, the Navy's standard operating procedure is to have marine mammal observers conduct surveys before each test and to postpone tests if threatened or endangered marine mammals are spotted in the project area. Navy range operators at Dabob Bay routinely receive training as marine mammal observers. Marine mammals do not frequent the bottom of Dabob Bay, which has a depth range from 375-600 feet (114-183 m); once the guidance wires and parachute settle on the bottom, they pose no entanglement threat.

Steller sea lions are most likely to occur in the project area during the late winter or early spring before moving south to their breeding grounds. Steller sea lions appear to be tolerant of boat noise and often approach vessels. Some of the louder test articles, such as the TOSS or Fleet sonar may cause Steller sea lions in the vicinity to avoid the test area when these devices are being used. Sound produced within the hearing range of the pinnipeds does not by itself imply behaviorial change or harassment. (Kastak et al. 1999). However, the TOSS system and Fleet sonar are used infrequently (about 10 and 3 times per year, respectively), and use of the project area by Steller sea lions is very low. Consequently, the proposed project would not affect Steller sea lions. Details on the potential noise effects to threatened and endangered marine mammals can be found in the separate Biological Assessment(Section 6.3-1).

Because there are no haulout areas for Steller sea lions in the area and due to the infrequency of their visits to the area, there are no effects to Steller sea lions from aircraft flights. In addition, Navy boats operating in the vicinity comply with the MMPA and the guidelines for approaching or harassing marine mammals, which restrict approaches to marine mammals to 100 yards (91 m). Range operations include wildlife monitoring and reporting to agencies including WDFW, NMFS, and USFWS.

Bald eagles are more susceptible to disturbance from helicopters than from fixed-wing aircraft. Helicopters often radiate more sound forward than backward, and can be heard for a longer time as they approach than as they move away (Richardson et al. 1995). Observations in Puget Sound indicate that about half of nesting bald eagles react to close approach by helicopters while only 7 percent react to approaches by fixed-wing aircraft (Watson 1993). Watson (1993) recommended that helicopters approach bald eagle nests at a elevation no less than 197 feet (60 m) above the nest, which minimized disturbance and allowed an escape route for any flushed birds. Grub and King (1991) recommended an aircraft exclusion zone of 2,050 feet (625 m) around eagle nests to avoid disturbance effects, with short duration flights allowed within 3,608 feet (1,100 m).

Navy aircraft pilots generally fly at least 1,000 feet (304 m) above land and 500 feet (152 m) above the water. Helicopter recoveries would have the greatest potential for disturbance of nesting eagles because the helicopters must fly low over the water to recover the test torpedo and to place it at the landing pad at Zelatched Point. While there are no eagle nesting locations at Zelatched Point, there is a nest about 1 mile (1.6 km) NNE from the landing pad, and several farther north along the Toandos Peninsula.

While no marbled murrelets nest along the shoreline of the DRBC they do feed in the water within 1,640 ft (500) m of the shoreline (Sustainable Ecosystems Institute 1997). Aircraft could potentially disturb feeding murrelets if frequent flight activity was concentrated near the shoreline and at a low altitude.

The risk of disturbance to eagles or murrelets would be greatest if during launch preparations or after recovering a torpedo a helicopter were to travel close to the shoreline at a low (<500 feet [152 m]) elevation. Other disturbance to eagles could be caused by helicopters entering or exiting Dabob Bay by flying low over the Toandos Peninsula and approaching within 500 feet (152 m) of an eagle nest. Flight rules have been formally adopted in the OMP and would significantly reduce the potential for effects to nesting bald eagles or to feeding marbled murrelets. These flight rules include a minimum elevation of 1,000 feet (304 m) over land and over water within 500 yards (457 m)of the shoreline, and 500 feet (152 m) above open water. In addition, all fixed-wing and helicopter flights must maintain a 656-foot (200 m) lateral no-fly buffer around bald eagle nests. These flight rules will ensure that there are no effects to bald eagles or marbled murrelets from the project operation.

In accordance with section 7(a)(2) of the Endangered Species Act of 1973 the Navy received concurrence with the determinations described above and in Appendix C from U.S. Fish and Wildlife Service and NMFS in letters dated 8 June 2001 and 7 June 2001 respectively.

3.6.2.2 Dabob Bay Limited Alternative

Environmental impacts would be the same as for the Preferred Alternative, with the difference that they would be geographically concentrated within the Dabob Bay MOA. No range testing or proofing operations addressed by the OMP or this assessment would occur in Hood Canal under this alternative, eliminating the opportunity for even temporary impacts to vegetation and wildlife resources in the Hood Canal area. Testing that would shift from Hood Canal to Dabob Bay would result in minor incremental disturbances because tests conducted in Hood Canal are of limited scope and duration compared to Dabob Bay tests. Therefore, impacts for the Dabob Bay Limited Alternative would still be below the level of significance for effects to threatened or endangered species.

3.6.2.3 No Action Alternative

Environmental impacts would be similar in type as for the Preferred Alternative. Environmental impacts of tests would need to be established by individual testing programs with NUWC Division Keyport. Quantity and type of tests may vary widely from events described in the Preferred Alternative, as impacts would depend on test program parameters established for each independent program.

3.6.3 Mitigation Measures

No impacts, as measured against the Endangered Species Act, are anticipated to any threatened or endangered species. This is based upon the analysis of operations and their potential consequences against these standards. To ensure the protection of nesting bald eagles and foraging marbled murrelets from disturbance by helicopters or fixed-wing aircraft, flight rules have been formalized for the DBRC and adopted in the OMP. Therefore, no mitigation measures are proposed or required for marine or terrestrial threatened or endangered species.

3.7 NOISE AND ACOUSTICS

This section reviews the noise and acoustic impacts of Navy operations in relation to the Marine Mammal Protection Act and the Endangered Species Act, and addresses noise and acoustic affects on fish, marine mammals, and the human environment. The analysis presented below shows that the Navy is in compliance with local and federal regulations for each of these areas.

3.7.1 Affected Environment

Sound intensity is measured in the logarithmic scale of decibels (dB), which approximates the way in which humans perceive sound. The dB unit refers to a standard that is used for comparison of different noise levels. The compressed logarithmic scale allows for comparisons of a wide range of sounds from a soft breeze to a large explosion.

While sound intensity is generally measured in the logarithmic scale of dB, the standard reference pressures used in air and water are different. The standard reference pressure for atmospheric sound is 20 micro-Pascals (μPa) at one meter. The standard reference pressure for water-borne sound is 1μPa at one meter. To make comparisons of noise levels, 26 dB must be subtracted from water-borne noise levels (referenced to 1μPa) to roughly estimate atmospheric noise levels (referenced to 20μPa) (NRDC 1999). In this EA, all decibel levels for atmospheric sound are referenced to 20μPa , while all decibel levels for water-borne sound are referenced to 1μPa.

Sound travels as a series of disturbances compressing and relaxing the medium it travels through, whether air or water. The frequency of a sound wave is the number of disturbances, or cycles, passing through a fixed point per second. Cycles per second are referred to in units of hertz (Hz) or kilohertz (kHz = 1,000 Hz). Low frequency sound is considered to be below 1,000 Hz and is the type of noise produced by large ships and the vocalizations of large whales.

3.7.1.1 Marine Environment

Most fish and some marine mammals appear to hear or react to low frequency sound (Department of the Navy 1999a; NRDC 1999). Mid frequency noise ranges from 1,000 Hz – 10,000 Hz and is produced by marine mammals (primarily odontocetes, the toothed whales), precipitation, and tactical sonar. High frequency noise is above 10,000 Hz and is produced by snapping shrimp, echolocation of marine mammals, ship depth finders, and fish finding sonar (Department of the Navy 1999a). The underwater background noise level in Dabob Bay ranges from 65 – 75 dB (Department of the Navy 1995c).

Sound Perception by Marine Finfish and Salmonids

In general, fish perceive underwater sounds in the frequency range of 50 to 2,000 Hz, with peak sensitivities below 800 Hz (Popper and Carlson 1998; Department of the Navy 1999a) (Table 3.7-1).

However, there are a number of taxonomic groups of fish, called hearing specialists, that have enhanced hearing abilities due to the mechanical coupling of the otolith organ (or fish ear) with the swim bladder (an air-filled sac which is used by some fish for buoyancy compensation) (Popper and Fay 1993). In some fish, this connection is made by a series of bones called Weberian ossicles. Other hearing specialist fish, such as the Clupeidae, have connections between the otolith organ, swim bladder, and lateral line system via a structure called prootic auditory bullae (Carlson 1994). Fish without swim bladders or without a connection between the otolith organ and swim bladder do not have enhanced hearing abilities. Table 3.7-1 summarizes what is known about the hearing abilities of the marine finfish and salmonid species discussed in this Environmental Assessment.

Limited injury to sensory hair cells in the otolith organs of fish from acoustic emissions has been shown only after exposure to continuous high intensity (180 dB) sounds (at 300 Hz) lasting 4 hours or longer (Hastings et al. 1996). Cox et al. (1986, 1987) also found some sensory hair cell damage in goldfish (*Carassius auratus*) exposed to pure sound tones at 250 and 500 Hz at intensities of 204 and 197 dB.

Hastings et al. (1996) concluded that extensive injury to the hearing ability of fish would occur at: (1) 220 to 240 dB for non-hearing specialists, and (2) approximately 50 dB less for hearing specialists. The Department of the Navy (1999a) concluded from these findings that fish would have to be: (1) within a ≥ 180 dB sound field from a source to possibly incur non-serious injury, and

Table 3.7-1: Hearing characteristics of selected fish in Dabob Bay and Hood Canal by family and order.

Fish Species	Fish Family	Fish Order	Hearing Characteristics
Coho salmon Chum salmon Steelhead trout Cutthroat trout Surf smelt	Salmonidae “ “ “ Osmeridae	Salmoniformes	Atlantic salmon can detect sounds from 30 Hz to about 400 Hz (Hawkins and Johnstone 1978; Knudsen et al. 1992) Rainbow trout sensitive to sounds from 25 to 800 Hz (Abbott 1973)
Pacific herring	Clupeidae	Clupeiformes	Hearing range for herring is 40-700 Hz (Denton and Gray 1979); American shad can detect sounds to over 180 kHz (Mann et al. 1997)
Pacific cod Walleye pollock Pacific hake	Gadidae	Gadiformes	Hearing range for cod, *Gadus morhua*, is 10-500 Hz (Chapman and Hawkins 1973); cod have also been shown to detect 38 kHz ultrasound signals (Astrup and Mohl 1993)
English sole Starry flounder	Pleuronectidae	Pleuronectiformes	The flatfish *Pleuronectes platessa* and *Limanda* can detect sounds up to 200 Hz (Chapman and Sand 1974), while *Pleuronectes* is able to detect sounds as low as 30 or 40 Hz (Karlsen 1992)
Pile surfperch Striped surfperch Lingcod Kelp greenling Cabezon Sand lance	Embiotocidae “ Hexagrammidae “ Cottidae Ammodytidae	Perciformes	Species in the order are sensitive to sounds <1,000 Hz, although there are some species that can detect higher frequencies
Copper rockfish Quillback Rockfish Brown rockfish	Scorpaenidae	Scorpaeniformes	Rockfish showed startle and alarm responses to airguns at 20-200 Hz above threshold of about 180 dB (re: 1 μPa) (Pearson et al. 1992)
Pacific lamprey River lamprey	Petromyzontidae	Petromyzoniformes	Data not available

Source: Department of the Navy 1999a; Hart 1980

(2) well within a sound field ≥ 180 dB at the onset of transmission (i.e., virtually co-located with the sound source) for serious injury to occur. In addition, they concluded that there was a low probability that fish would be within a ≥ 180 dB sound field long enough (i.e. several to many hours) to cause adverse effects.

Salmonidae

Fish in the family Salmonidae include salmon, trout, and char. Although Salmonidae do possess swim bladders, they are not hearing specialists as they lack the mechanical coupling via Weberian ossicles between the otolith organ and the swim bladder (Hawkins and Johnstone 1978).

Atlantic salmon (*Salmo salar*) have been found to perceive underwater sound up to 380 Hz. However, other studies have shown that sensitivity to sound in Atlantic salmon drops off sharply above 150 Hz (Knudsen et al. 1992, 1994).

Facey et al. (1977) tested the response of Atlantic salmon parr to pulsed ultrasonic transmitters transmitting at: (1) 75 kHz (258 and 194 pulses per minute), (2) 75 kHz (180 pulses per minute), (3) 75 kHz (200 pulses per minute), and (4) 55 kHz (100 pulses per minute). They found that the salmon were unable to detect any of these transmissions.

Rainbow trout have been found to be sensitive to sounds from 25 to 800 Hz (Abbott 1973). Juvenile chinook salmon have been shown to exhibit avoidance responses to low frequency sound up to 280 Hz, with no response to higher frequencies (VanDerwalker 1967 as cited in Carlson 1994). The strongest response was found for sounds between 30 and 150 Hz. The salmon were found to respond to low frequency sounds, but only at very short ranges – within distances of 2 feet (0.6 m) or less from the sound source, even though the sounds were at levels up to 156 dB (re: 1μPa).

Carlson (1994) in a review of 40 years of studies concerning the use of underwater sound to deter salmonids from hazardous areas at hydroelectric dams and other facilities concluded that salmonids were: (1) only able to respond to low frequency sound, and (2) only able to react to sound sources within a few meters of the source. He speculated that the reason that underwater sound had no effect on salmonids at distances greater than a few meters from the source is that they are reacting to water particle motion / acceleration, not sound pressure as such. Detectable particle motion is only produced within very short distances of a sound source, although sound pressure waves travel much farther.

Clupeidae

Marine fish in the family Clupeidae, which include herring, shad, and alewives, fall into the category of hearing specialists (Carlson 1994). American shad (*Alosa sapidissima*) have been found to perceive sounds up to 180 kHz, resulting in avoidance behavior (Mann et al. 1997). Blueback herring (*Alosa aestivalis*) have been found to exhibit avoidance behavior to underwater sounds between 110 and 140 kHz at sound pressure levels up to 200 dB (re: 1μPa), at distances up to 197 feet (60 m) from the sound transducer (Nestler et al. 1992). Use of ultrasound of these frequencies and intensities was proposed as a way to keep blueback herring from being entrained at hydroelectric dams on the Savannah River. Alewives (*Alosa pseudoharengus*) were successfully kept away from a nuclear power plant intake using sound of 122 to 128 kHz at an intensity of 190 dB (re: 1 μPa) (Ross and Dunning 1996).

Pacific herring, which are present in the waters of Dabob Bay and northern Hood Canal, have been found to exhibit temporary avoidance reactions in response to tape recordings of large, constantly moving vessels, small vessels on accelerated approach, and a series of electronic sounds from 200 to 1,000 Hz, with varying intensities (Schwarz and Greer 1984). The herring did not respond to tape recorded echosounder or sonar sounds (tapes with recorded sounds up to 20 kHz), or to various natural sounds, such as rain on water, killer whale vocalizations, sea lion barking, etc.

No studies were located indicating that Pacific herring can perceive ultrasound emissions, as shown for other species in the Clupeidae. However, Pacific herring population stocks are routinely estimated by hydroacoustic surveys in Washington State (Kautsky et al. 1991). The surveys are conducted with dual- and split-beam echosounders emitting ultrasound signals of 120 kHz and 38 kHz, respectively. This suggests that herring may not be able to perceive these signals.

Gadidae

In addition to their normal hearing range of 10-500 Hz, Atlantic cod (*Gadus morhua*) have also been shown to detect intense ultrasound of 38 kHz with an average threshold of 194 dB (re: 1 μPa) (Chapman and Hawkins 1973; Astrup and Mohl 1993). This ultrasound signal was detected at a range of 33-97 feet (10 to 30 m). No information was located for the hearing abilities of Pacific cod (*Gadus macrocephalus*), or other fish in the Family Gadidae present in Dabob Bay and northern Hood Canal.

Scorpaenidae

Pearson et al. (1992) showed that captive rockfish in net pens would exhibit startle and alarm responses during 10 minute exposures to airgun sounds ranging from 20 to 200 Hz, above threshold intensities of about 180 dB (re: 1 μPa). Using a 255 dB airgun array and transmission losses characteristic of California coastal waters, sound levels eliciting: (1) startle responses would be produced within 3.3 feet (1 m) of the sound source, and (2) alarm responses would be produced within 456 feet (193 m).

3.7.1.2 Human Environment

The majority of the DBRC in Jefferson County has a low population density and a lack of industrial noise sources. Noise levels in the area are largely dependent on the weather and other natural sources. However, there is some civilian use of the waterways, which adds to the background noise levels.

The support operations and personnel and equipment transportation take place in the area of NUWC Division Keyport and SUBASE Bangor in Kitsap County. Both of these areas are more developed than the DBRC and have a correspondingly higher background noise level.

Based on current population density (Jefferson County 1998), it is assumed average daily noise levels in the Jefferson County region of the DBRC are less than 55 A-weighted decibels (dBA) during the day (7:00 a.m. to 11:00 p.m.) and 45 dBA during the night (11:00 p.m. to 7:00 a.m.). The average daily noise levels in the operations areas of Kitsap County would be expected to be approximately 65 dBA during the day and 45 dBA during the night. The majority of noise receiving properties in either county affected by NUWC

Division Keyport activities would be either in the Class A environmental designation for noise abatement (EDNA) (residential property) or Class C EDNA (silvicultural property).

3.7.2 Environmental Consequences

3.7.2.1 Preferred Alternative

Marine Environment

The following section provides an analysis of the project impacts to fish, invertebrates, and marine mammals.

In a comprehensive review on the effects of LF noise to fish (Department of the Navy 1999a), a threshold of 180 dB was used to define the potential injury to fish. Table 3.7-2 shows the primary in-water noise sources for DBRC operations.

Table 3.7-2: Primary In-water Noise Sources in the DBRC.

Source	Noise frequency	Noise intensity	Signal duration range	Distance to 180dB Level
Large boats and submarines (engine noise)	50 – 150 Hz	160 – 170 dB	continuous when running	<1m (<1yd)
Small boats and torpedoes (engine noise)	100 – 1,000 Hz	150 – 160 dB	continuous when running	<1m (<1yd)
Tracking sonar	35 – 75 kHz	194 dB	pulses < 0.5 seconds	5m (6yd)
End of run pingers	37 or 45 kHz	168 dB	< 0.5 seconds	<1m (<1yd)
Sonar transmissions (torpedoes, range targets and special tests)	8 – 68 kHz	233 dB	< 1.5 seconds	823m (900yd)
Special Sonars (UUV's and other devices)	100-1000 kHz	229 dB	<0.5 seconds	184m (201yd)
Towed submarine simulator (TOSS)	100 Hz – 10 kHz	170 dB	1 second to several minutes; peak values 1 – 10 seconds	<1m (<1yd)
Fleet sonar (aircraft, surface ships and submarines)	50 Hz – 8 kHz 15 – 40 kHz	247 dB 238 dB	0.5 – 10 seconds; mostly 0.5 – 1 seconds	7708m (8430yd)
Aid to navigation (range equipment)	74 – 76 kHz	210 dB	1 second every 2	26m (29yd)

Recently the NMFS analysis for seismic monitoring in the state of Washington used the value of 180 dB as a harassment threshold for marine mammals (67 FR 5792). Finneran, et al 2000, showed that a peak sound pressure level of 180 dB (re: 1 μPa) represents a conservative estimate of no temporary threshold shift (TTS), considered by NMFS to be the upper limit of Level B harassment under the Marine Mammal Protection Act (MMPA). The

180 dB received energy level is for transmissions in excess of 100 seconds. This is illustrated in figure 6(a) from Finneran, et al 2000, showing peak sound pressure levels vs. fatiguing stimulus duration for pinnipeds and odontocetes. The majority of the tests in the DBRC are of a moving, transient nature. By far the majority of the individual transmissions in the DBRC are for less than this time period, so exposure of an animal to 100 seconds of acoustic energy > 180 dB is highly unlikely. The primary marine mammals that could be affected by operations in the DBRC are pinnipeds since operations are halted upon the observation of cetaceans. Therefore, this report will use the value of 180 dB as the reference point for acoustic analysis for both fish and marine mammals.

The transmission loss formula used for Dabob Bay has been specifically calculated for the water conditions and bottom type generally found there by the Navy. Because of this the formula used is neither a pure spherical nor cylindrical spreading formula, but uses features of both. This formula has been used for many years by the Navy in acoustic measurement calculations for Dabob Bay and has been validated through empirical testing by the Navy. The Navy uses the formula 15 log (R)+ αR + 8.7 (Keys, 1990) to take into account Lloyd Mirror interference and deviations from spherical spreading for distances beyond 55m (60yd). For distances less than 55m (60yd) spherical spreading using the formula 20 Log (R)+αR is used for transmission loss calculations. These two transmission loss formulas were used in developing the "distance to 180 dB level" column in Table 3.7-2. Precedence for using a specialized formula exists within the acoustics world for specific cases and 15 log R was used by Mercado and Frazer in their document on Humpback Whale Sound Transmission (Mercado et al, 1999).

Fish

Using the 180 dB threshold, no harm would result to fish outside the distances described above. In the unlikely case that fish were within these distances, they would be very unlikely to remain the length of time (i.e., more than several hours) to sustain any injury. In addition, the fish would have to be exposed to continuous sound above 180 dB for at least several hours for injury to occur, unlike the pulsed sound emitted by these four sources. Most of the acoustic emissions in DBRC operations are not continuous, except for engine noise below 180 dB. Thus, the potential effects of these emissions would be limited to the production of avoidance reactions in fish, which is a temporary behavior leaving no permanent injury to the fish, and which only occurs in certain circumstances, as discussed below in more detail.

Surface Ship, Submarine and Torpedo Engine Noises - Several researchers have shown that fish such as herring react to vessel noise at close to moderate ranges (within 82 to 3,280 feet [25 to 1,000 m]) with temporary avoidance responses (Mitson 1993; Soria et al. 1996; Misund et al. 1996). Salmonids react to sounds only within a few meters of the source (Carlson 1994). It is possible that marine finfish or salmonid fish in Dabob Bay or Hood Canal could find themselves in range of these sound sources. However, even if these sources are perceived, the fish would react by swimming away from the sound source, with no permanent harm inflicted.

In addition, low frequency engine noises emitted by surface ships during range operations are the same or similar to those emitted by surface ship operations in all parts of Puget Sound. In fact, surface ship operations in Dabob Bay are less intense than in other parts of Puget Sound due to its remote location and low level of urban development, producing a very quiet acoustic environment (MAKERS 1999). This is one of the reasons Dabob Bay is used for torpedo testing operations.

Low Frequency Sonar Emissions - Perceivable low frequency sonar emitted from submarines is likely to be in waters deeper than many marine finfish or salmonids frequent. However, it is possible that marine finfish or salmonid fish in Dabob Bay or Hood Canal could find themselves within close range of low frequency sonar emitted from surface ships or countermeasure devices. In addition, some demersal and semi-demersal finfish may be present in deeper waters used by submarines. However, even if these low frequency sonar sources are perceived, the fish would react by swimming away from the sound source with no permanent harm inflicted.

High Frequency Ultrasound Emissions - High frequency ultrasound emissions, such as those used for tracking in ongoing and future DBRC operations, are unlikely to adversely affect most marine finfish or salmonids of any life stage in the waters of the MOAs. This is due to the following: (1) it is very unlikely that marine finfish or salmonids would happen to be close to high frequency sound sources used in the MOAs, as they would be emitted by moving torpedoes and other devices in the open waters of Dabob Bay and northern Hood Canal; (2) most marine finfish and salmonids only perceive and exhibit avoidance responses to low frequency sounds below about 2,000 Hz, with peak sensitivities below 800 Hz; and (3) even fish able to perceive high frequency ultrasound emissions, such as possibly Pacific herring and Pacific cod, would react by swimming away from the sound source with no permanent harm inflicted.

Invertebrates

Very few studies have been conducted on acoustic perception by marine invertebrates. Offutt (1970) found that American lobsters could perceive low frequency sounds in the range 37 to 150 Hz, but had a high intensity threshold. Due to the high perception threshold found by this study, it was concluded that decapod crustaceans would only perceive low frequency sonar emissions within the nearfield (tens of meters) of sonar sources, where invertebrates would unlikely be present (Department of the Navy 1999a). This would also be the case during ongoing and future operations of the Dabob Bay and Hood Canal MOAs, as sources of low frequency sound would be surface vessels, submarines, and torpedoes in open waters where benthic invertebrates such as bivalves, crabs, and shrimp would be absent. Pink shrimp can be found up in the water column feeding at night, but range operations are conducted primarily in daytime hours. Therefore, based on all of the above, no significant acoustic impacts to marine invertebrates are expected.

Marine Mammals

This analysis of effects to marine mammals focuses on potential acoustic effects. It is important to note that if cetaceans are present and expected to be within the ensonified area, no testing would occur.

During a test, all boat engines are shut off to facilitate recording and tracking so there is no overlap between boat noise and test vehicles. Background noise in Dabob Bay ranges from about 60 to 75 dB (Department of the Navy 1999c). Testing generally occurs during daylight hours Monday through Friday.

Immediately before each test, marine mammal surveys are conducted by trained Navy observers as a standard operating procedure. If harbor seals are present within 100 yards (91 m) of the expected system path the test will be postponed. The abundance of harbor seals in the DBRC has lead to this operating procedure.

Cetaceans – Although gray and killer whales are uncommon in the DBRC they are the cetaceans most likely to visit the DBRC, therefore the following analysis focuses on these species. Research on the effects of boat traffic and underwater noise on gray whale behavior has produced a range of results. In breeding lagoons, gray whales do not appear to be disturbed by idling or slow-moving boats and often approach these vessels (Norris et al. 1983). Dahlheim (1987) concluded that gray whales are not seriously disturbed by the noise of small boats, but they often change their call behavior to compensate for the masking effect of boat noise. Migrating whales have been documented to change course to avoid a vessel at a distance of 656–984 feet (200–300 m) (Wyrick 1954). However, ships often are able to approach within 49 feet–98 feet (15-30 m) of gray whales without any apparent behavior change (Schulberg et al. 1989). Gray whales have shown avoidance of underwater tape sounds of oil drilling operations that ranged from about 110 to 122 dB. In a test of the impacts of LF sonar to marine mammals, gray whales avoided exposure to noise levels of 115 to 125 dB (Department of the Navy 1999a).

Reactions to boats can vary greatly even within a species (Richardson et al. 1995). Killer whales have shown mild reaction to boats within 1,200 feet (400 m), sometimes show no avoidance reaction to vessels, and may often approach them (Richardson et al. 1995). Gray whales or killer whales entering Dabob Bay during a Navy test may avoid portions of the bay because of the associated boat traffic and noise disturbance. Gray whales are more sensitive to LF sound than killer whales and may be more likely to avoid the sound of small boats and the test vehicles. Support vessels, torpedoes, the TOSS, and Fleet sonar produce sound between 150 and 247 dB (Table 3.7-2).

Only the Fleet sonar would have the potential to disturb whales over a broad area of the DBRC. The Fleet sonar has limited application in the DBRC, and because of its potential effect would not be used at high power levels without further analysis and consultation with NMFS. The effects of boats, test torpedoes, and the TOSS are negligible.

Gray whales and killer whales are uncommon visitors to Dabob Bay. Standard operating procedure is to postpone all range operations in the DBRC when cetaceans are present. Therefore, range operations in Dabob Bay and Hood Canal would have no effect on cetaceans.

Pinnipeds - Pinnipeds seem to be most sensitive to mid-frequency sounds rather than the low frequency sounds which are produced by small boat and torpedo engines. Mid-frequency sounds are produced by various sonar systems as described in table 3.7-2. Few data on the effects of non-explosive sounds on the hearing thresholds of marine mammals have been obtained. However, received sound levels must far exceed the animals hearing threshold for there to be any Temporary Threshold Shift (TTS) in the animal's hearing (67 FR 5794). The NMFS (66 FR 43444) considers "…harassment to have occurred if the marine mammal has a significant behavioral response in a biologically important behavior or activity." Disruption would need to be to the animal's normal pattern of biological behavior, not just a momentary reaction on the part of the marine mammal. In the NMFS (66 FR 22452) response to comments for the USS CHURCHILL Incidental Take Permit, NMFS further states "…if the only reaction to the activity on the part of a marine mammal is within the normal repertoire of actions that are required to carry out that behavior pattern, NMFS considers the activity not to have caused an incidental disruption of the behavioral pattern…" Furthermore, audibility by a marine mammal does not imply dramatic behavior changes or auditory damage (Kastak et al. 1999). Some mid-frequency noise may cause pinnipeds to avoid parts of the DBRC during tests. However, mid-frequency sound produced by activities within the DBRC is not of the kind that would cause significant biological disruption or harassment because they are of short duration and from mobile sources. As long as the marine mammals actions are within the normal range of biological activity and behavior, the animal's reaction to mid-frequency sound is not considered significant (66 FR 43444).

In the water, harbor seals and sea lions appear to be tolerant of boats and often approach vessels (Richardson et al. 1995). Both exhibit a greater sensitivity to visual human presence at haul-out sites than in the water. Harbor seals haul out on mudflats exposed at low tide in the Dabob Bay MOA, but California sea lions prefer rocky islands, docks, or buoys. No documented California sea lion haul-out sites occur in the project area. Research indicates that harbor seals become alert as boats approach within 492–656 feet (150-200 m) and vacate a haul-out site when vessels approach within 197 feet (60 m) (Johnson et al. 1989). When only a few pinnipeds leave a haulout site but many alert to a disruption, this is considered a non-significant behavioral response (66 FR 43444). Visual disturbance by Navy vessels is minimal because the vessels primarily use the center of Dabob Bay in the vicinity of the underwater hydrophone array (Figure 2.2-2) and only approach land at the Zelatched Point facility. There are no documented harbor seal haul-out sites near Zelatched Point, and vessel traffic would not typically approach or disturb seals that use sites along the shoreline of Dabob Bay or Hood Canal. Because of their documented tolerance of vessel noise (Richardson et al. 1995), and the avoidance of haul out sites by Navy vessels, there would be no effect to harbor seals or California sea lions in the project area from boat noise or visual presence produced by the Proposed Action.

Harbor seals on haul-out sites may be disturbed by overflights of fixed-wing aircraft or helicopters taking part in Navy activity. In Alaskan studies, aircraft flights below 394 feet (120 m) caused seals to vacate beaches while responses to overflights at altitudes of 394–1,000 feet (120-305 m) varied. Helicopters and large aircraft were reportedly more disturbing than small aircraft (Johnson 1977). Other studies indicate that harbor seals usually reacted strongly to overflights below 200 feet (61 m), but those above 249 feet (76 m) caused only minor reactions (Hoover 1988). In California, harbor seals reacted to helicopters below 1,000 feet (305 m) by leaving haul-out sites for the water (Bowles and Stewart 1980).

Navy fixed-wing aircraft over the land and near shore fly at elevations above 1,000 feet (305 m) and pose no disturbance threat to harbor seals that use haul-out sites in the Dabob Bay MOA. Helicopters used to launch or retrieve test vehicles transit no lower than 1,000 feet (305 m) above land and 500 feet (153 m) over water. Helicopters fly as low as 50 feet (15 m) above the water when launching or retrieving a torpedo and returning it to the Zelatched Point heli-pad, but there are no harbor seal haul-out sites in this vicinity.

Helicopters do not enter Dabob Bay from the north, where there are several haul-out sites used by harbor seals (Figure 3.4-9). Entry into the bay airspace by helicopters is usually via Hood Canal or over the Toandos Peninsula.

Fixed-wing aircraft used in Navy tests are primarily P-3s; launch helicopters are SH-60s; and recovery helicopters are Hughes 500s, or equivalent. General flight rules for helicopters and fixed-wing aircraft include:

- Flights over land must be at a minimum elevation of 1,000 ft (305 m);
- Flights over water must be at a minimum elevation of 500 ft (152 m);
- Flights must maintain a 656-foot (200 m) lateral no-fly buffer around bald eagle nests; and
- Flights within 500 yards (457 m) of the shoreline must be at a minimum elevation of 1,000 ft (305 m).

Estimates for future operations include 10 fixed-wing aircraft torpedo or helicopter launches/year, and 10-20 helicopter recoveries/year. The most likely point of disturbance would be at Zelatched Point where retrieval helicopters must approach the shoreline to place recovered torpedoes on the heli-pad.

Since helicopters only approach the shoreline at Zelatched Point, and because of the flight rules regarding elevation above land, no disturbance to harbor seal haul-out sites is anticipated.

Human Environment

Many of the activities covered in the Proposed Action include ground transportation. The majority of ground transportation takes place in Kitsap County (less than 25 trips per day, as discussed in Section 3.3) and would not be expected to add measurably to the current traffic noise. Ground travel in Jefferson County is generally associated with travel between Keyport and the Zelatched Point Range Control site, typically less than five round trips per day. This is also not expected to add measurably to noise levels generated by current traffic patterns.

Noise from watercraft is generally associated with the diesel- or gasoline-powered engines, which, on the larger YTTs, generate noise equivalent to shore fire patrol boats. Additionally, ship signals, loudspeakers, and microphone noise may be audible to other ships or shore receptors. During the activities covered by the Proposed Action, surface watercraft usually have their engines stopped, and noise is kept to a minimum to obtain the best readings from the subsurface monitors. As such, the noise generated by Naval vessels during operations would be similar to noise levels from other boating activities. The greatest potential for impact would occur during transit from the Hood Canal and Dabob Bay MOAs to the operations site and during pre-operations setup. The Dabob Bay MOA is generally used only during daylight hours. In addition, both the canal and bay are regular transit points for a variety of civilian craft, which would generate noise levels similar to those anticipated by the Naval craft. Due to these two points and the fact that there are few sensitive receptors (due to low population density), it is not anticipated that Navy vessels associated with DBRC operations would generate a noticeable increase in community noise levels.

Both fixed-wing and rotary-wing aircraft are involved in some of the activities in the DBRC. A maximum of 30 operations involving aircraft or helicopters are anticipated in any given year, typically fewer. Both planes and helicopters maintain high altitudes when inbound to and outbound from the range area to minimize impacts on wildlife. The aircraft and helicopters usually remain audible the entire time they are on-station in the DBRC. The topography of the area generally reduces noise levels when the craft are not in direct line-of-sight, but sound attenuates (fades) slowly over water. During their presence in the range, aircraft would dominate the noise environment. However, the increase in ambient noise levels is temporary and the use of aircraft is relatively infrequent. Although the State of Washington has rules governing noise impacts which are based on land use (WAC 173-60), aircraft noise levels between the hours of 7 a.m. and 10 p.m. are specifically exempted (WAC 173-60-050). No significant noise impacts are expected due to aircraft operations.

The weapons tests themselves do not generate noticeable levels of noise. The weapons systems are launched using compressed air or pressurized water and air. The tests themselves will have no impact on the area's noise profile.

3.7.2.2 Dabob Bay Limited Alternative

Environmental impacts would be the same as for the Preferred Alternative, with the difference that they would be geographically concentrated within the Dabob Bay MOA. No range testing or proofing operations included in the OMP or this EA would occur in Hood Canal under this alternative, eliminating the opportunity for even temporary impacts to marine fish and marine mammals, particularly gray whales and killer whales, in the Hood Canal area. Testing that is currently conducted in Hood Canal that would shift to Dabob Bay would result in minor, incremental increases in noise. Any additional impacts above those described for the Preferred Alternative would not cause significant impacts.

For the human environment, choice of this alternative would require a shift of all testing and proofing activities to the Dabob Bay MOA, as no range testing or proofing operations would occur in Hood Canal under this alternative. This would require approximately 20 additional 2-hour round trips per year to Dabob Bay by a YTT or other launching craft, contributing a small amount of engine noise to the Hood Canal environment. No operations involving aircraft currently take place in Hood Canal, so aircraft noise patterns would not be affected by this alternative.

3.7.2.3 No Action Alternative

Impacts for the marine and human environments would be similar in type as for the Preferred Alternative. Environmental impacts of tests would need to be established by individual testing programs with NUWC Division Keyport. Quantity and type of tests may vary widely from events described in the Preferred Alternative, as impacts would depend on test program parameters established for each independent program.

3.7.3 Mitigation Measures

No significant noise related impacts, as measured against the Marine Mammal Protection Act, the Endangered Species Act, and WAC standards, are anticipated. This is based upon comparative analysis of operations and their potential consequences against established Navy threshold limits and national standards. The Navy will continue to conduct marine mammal surveys prior to operations and postpone operations until marine mammals leave the project area. The Navy will continue to train range vessel operators as marine mammal observers. Therefore, no additional mitigation measures are proposed or required.

3.8 CULTURAL RESOURCES

This section reviews operations in relation to the Protection of Historic and Cultural Properties (36 CFR 800), Protection of Archeological Resources: Uniform Regulations (32 CFR 229), State Historic Preservation Office Regulations, Indian Sacred Sites Executive Order 13007, and Consultation and Coordination with Indian Tribal Governments Executive Order 13084. This section describes the cultural resources potentially present in the project area include prehistoric archaeological sites, historic sites (including shipwrecks), and traditional cultural properties (TCPs). The analysis below shows that the Navy is in compliance with local and federal regulations for each of these areas.

3.8.1 Affected Environment

Activities proposed in the OMP primarily consist of continued torpedo range testing in the waters of Dabob Bay and Hood Canal and continued operations of shoreline activities at Zelatched Point, and at four other places where warning lights are posted.

3.8.1.1 Previous Cultural Resource Studies

A review of records at the Washington State Office of Archaeology and Historic Preservation (OAHP) indicates that no previous cultural resource studies have been conducted, nor have archaeological resources or TCPs been recorded specifically on the shoreline areas of the Range Control Center at Zelatched Point, or at the warning light locations at Pulali Point, Sylopash Point, and the southeastern edge of Bolton Peninsula. In addition, no archaeological resources or TCPs have been recorded within the waters of the three MOAs and their connecting waters.

Archaeological Studies

A review of archaeological surveys for the broader study area, including areas adjacent to or near the MOAs, indicates that hunter-fisher-gatherers used shoreline areas on Hood Canal in the DBRC area for gathering and processing salmon, shellfish, and land game. Archaeological surveys adjacent to or near the project area are summarized in Table 3.8-1.

One hunter-fisher-gatherer archaeological site was recorded on an area near upper Dabob Bay; three hunter-fisher-gatherer sites and two historic period occupation areas were recorded on the Toandos Peninsula; and three hunter-

Table 3.8-1: Archaeological Surveys in the Vicinity of the DBRC.

Author and Date	Report Title	Location	Distance from Dabob Bay Range Area OMP	Comments
Wessen 1992	*An Archaeological Survey of the Phillips Parcel, Bolton Peninsula, Jefferson County, Washington*	East shore of Bolton Peninsula near Broad Spit	Approximately one mile north of the northern boundary of the Dabob Bay MOA	Shell midden (45JE205) at the mouth of a stream on the shore of Dabob Bay.
Hess et al. (1990)	*Archaeological Resource Assessment of Naval Undersea Warfare Engineering Station Properties in Jefferson and Kitsap Counties, Washington*	Surveyed Toandos Buffer Zone on eastern shore of Toandos Peninsula as part of assessment.	0.5 mile west of the Hood Canal MOA 2 (South)	Two shell middens and historic land use areas along the western shoreline of Hood Canal. The shell middens were not assigned OAHP site numbers.
Stilson 1987	*Cultural Resource Assessment of the Proposed Hyper-Fix Navigational Beacon Antenna, U.S. Naval Reservation, Toandos Peninsula, Jefferson County, Washington*	Eastern shore of Toandos Peninsula	0.5 mile west of the Hood Canal MOA 2 (South)	Fire cracked rock and historic homestead on shoreline.
Daugherty 1973a 1973b	Letters to Trident Joint Venture	SUBASE Bangor	On the eastern edge of the Hood Canal MOA 1 (North)	No archaeological resources identified.
Lewarch et al. 1993	*Cultural Resources Overview and Probabilistic Model for SUBASE Bangor and Camp Wesley Harris, Kitsap County, Washington*	SUBASE Bangor	On the eastern edge of the Hood Canal MOA 1 (North)	Three shell middens (45KP106, 45KP107, 45KP108) on eastern shoreline of Hood Canal. Numerous upland historic land use areas identified.

fisher-gatherer shell midden sites were recorded and evaluated for their eligibility for listing in the National Register of Historic Places (NRHP) on the shoreline of SUBASE Bangor. The first of these (archaeological site 45JE205) is a shell midden on Dabob Bay with nine species of shellfish, deer bone, fish bone, charcoal, fire modified rock, and historic artifacts (Wessen 1992).

The assemblage of archaeological materials at 45JE205 indicates a multiple activity, hunter-fisher-gatherer occupation at a stream mouth on the shoreline of upper Dabob Bay. The site was estimated to date from the later phase of aboriginal settlement, prior to Euroamerican contact. Archaeological site 45JE205 has not been formally evaluated for listing in the NRHP; however, Wessen (1992) suggested that the site was probably NRHP eligible.

Archaeologists conducted test excavations at three hunter-fisher-gatherer shell midden sites at SUBASE Bangor and recommended that two of the sites (45KP106 and 45KP107) were probably not eligible for listing in the NRHP (Lewarch et al. 1996). Radiocarbon dates from the Carlson Spit Shell Midden (45KP108) demonstrated that hunter-fisher-gatherers occupied the area around 1,000 years ago and again within the past 400 years. The Carlson Spit

Shell Midden (45KP108) is probably eligible for listing in the NRHP (Lewarch et al. 1996).

Stilson (1987) observed evidence of hunter-fisher-gatherer and historic period occupations on the west side of Hood Canal, on the Toandos Peninsula opposite SUBASE Bangor, but did not record the materials as a site and did not assess probable site significance. Hess et al. (1990) identified two shell middens and an historic occupation area on the Toandos Peninsula. One of the shell middens, the Tower Point Site, had dense deposits of eroding fire modified rock and is probably eligible for listing in the NRHP. The hunter-fisher-gatherer shell midden sites and historic deposits that have been recorded previously on the Hood Canal shoreline demonstrate the types of archaeological materials that can occur on the shoreline access areas within the DBRC, especially at Whitney Point and Zelatched Point.Data from previous archaeological surveys and results of archaeological test excavations at the SUBASE Bangor shell midden sites allow us to estimate the types of archaeological resources that may occur at the shoreline access and activity areas in the DBRC. Shell middens are associated with sandspits and near streams in areas adjacent to the DBRC. Shoreline areas designated for project activity and access have a moderate probability for hunter-fisher-gatherer shell middens. Shoreline access areas also have a moderate probability for historic period resources, either as occupations that were part of hunter-fisher-gatherer shell midden sites, or as separate settlement areas used by Euroamericans in the historic period.

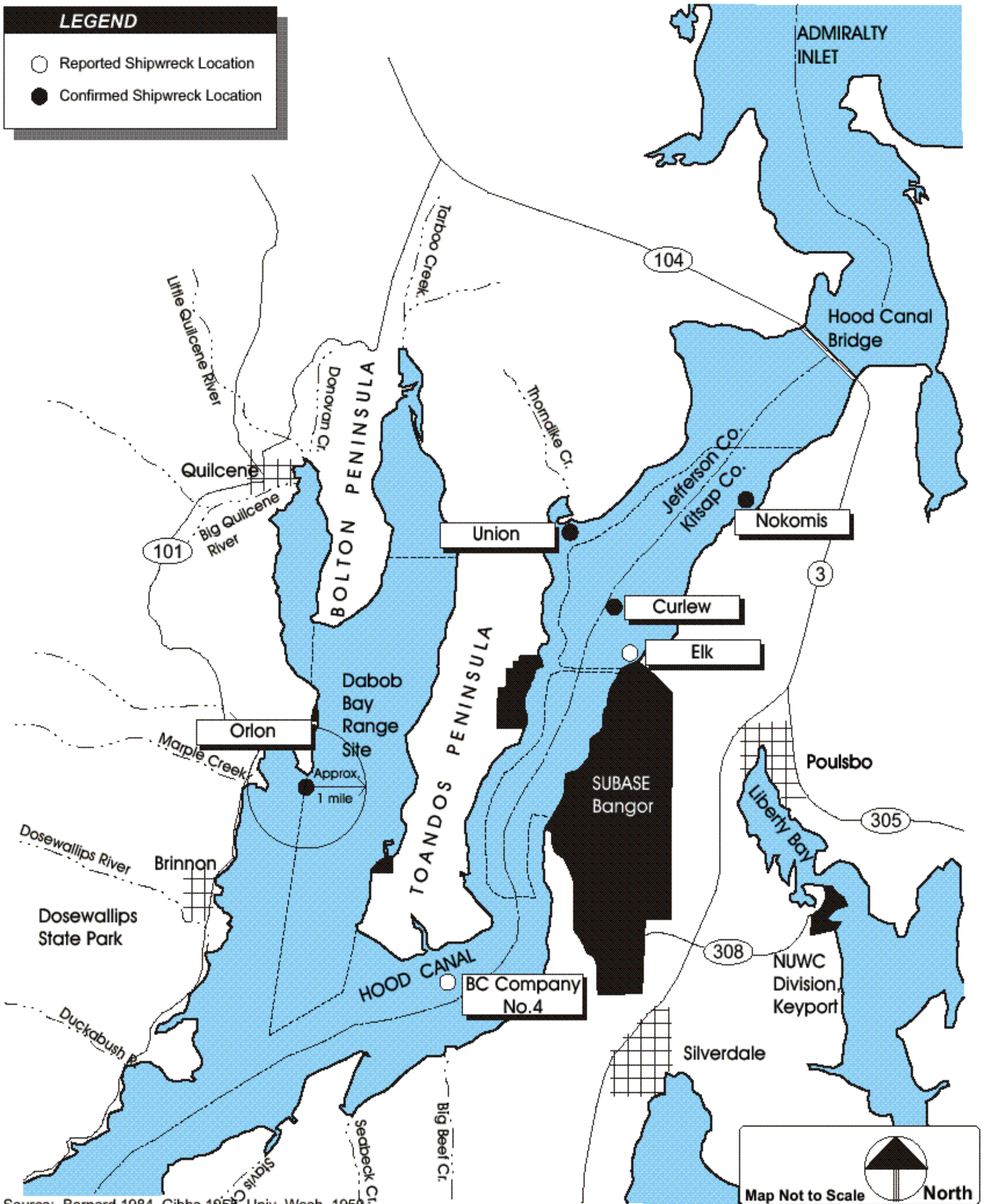
Shipwrecks

Six possible shipwrecks are in the DBRC based on a preliminary review ofshipwreck data (Figure 3.8-1). Review consisted of examination of maps showing shipwrecks within Hood Canal and publications on maritime history in Puget Sound. One of the shipwrecks (*Elk*) appears to have been incorrectly mapped and is probably outside the project area. Table 3.8-2 summarizes the shipwreck data.

Data on shipwrecks in the DBRC were retrieved through review of maps of Puget Sound shipwrecks on file at the University of Washington Libraries. The maps provide fixed locations within the DBRC for the *Curlew, Nokomis*, and *Orlon* (Figure 3.8-1). The fixed location of the steamer *Union* is just outside the DBRC in Thorndyke Bay (Figure 3.8-1). Reported (not confirmed) shipwreck locations are shown for the *Elk* and *BC Company No. 4*. It is important to note that shipwreck locations are influenced by tides and storms and can shift up to one mile (1.6 km) in any direction from the location shown.

Ethnography

The DBRC and associated warning light locations are within the territory of the Twana people (Elmendorf 1992:20-21; Spier 1936:32). The Twana had



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Shipwrecks Within or Adjacent to Dabob Bay/Hood Canal MOAs

Figure 3.8-1

Table 3.8-2. Shipwrecks Within or Adjacent to the DBRC.

Ship Name	Location	Source	Description
Orlon	Off Pulali Point in Dabob Bay MOA	Gibbs 1955	Eleven ton vessel burned and sunk.
BC Company No. 4	Off southern point of Toandos Peninsula within Connecting Waters	Gibbs 1955	Twelve ton vessel lost and exact location unknown.
Union	In Thorndyke Bay outside of Hood Canal MOA 1 (North)	Barnard 1984; Gibbs 1955	Thirty-one ton vessel burned and sunk.
Elk	At Vinland on Hood Canal Hood Canal MOA 1 (North) but probably in Keyport on Liberty Bay outside of Dabob Bay Range Area	Barnard 1984; Gibbs 1955; Newell 1960:207	Formerly named *Katherine*, the *Elk* was built in 1890 on Lake Washington at Houghton. The ship apparently burned and sunk near Keyport on Liberty Bay and was incorrectly mapped at Vinland by Gibbs 1955.
Curlew	Off Vinland on Hood Canal in Hood Canal MOA 1 (North)	Gibbs 1955	Eleven ton vessel burned and sunk.
Nokomis	Off Lofall on Hood Canal in Hood Canal MOA 1 (North)	University of Washington 1950	Namesake of famous wreck in Mexico.

Source: Barnard 1984; Gibbs 1955; University of Washington 1950.

winter villages on both sides of Hood Canal, including the Quilcene and *Dabob* groups that lived near the waters of the Dabob Bay MOA.

The Twana, whose descendants now comprise the Skokomish Tribe, assigned place names to four shoreline areas designated for continued activities and access under the OMP: (1) Whitney Point was a summer campsite (Elmendorf 1992:43); (2) Pulali Point is probably derived from the native name of a wild cherry, Pule3la (Waterman ca. 1920); (3) Zelatched Point was a summer campsite (Elmendorf 1992:45); and (4) Sylopash Point a probable mythological place (Elmendorf 1992:42). The Twana frequented Dabob Bay and the surrounding beaches for seasonal salmon fishing and clam digging (James 1993:60-64).

The neighboring Chemakum, Klallam, and Suquamish people also used Hood Canal for summer fishing and gathering (Elmendorf 1992:287; Gunther 1927:195; Lane 1974:3-4, 1975:21, 1981:5). Descendants of the Klallam are currently members of the Port Gamble S'Klallam, Jamestown S'Klallam, and Lower Elwha Klallam Tribes. The Suquamish are members of the contemporary Suquamish Tribe.

History

The first non-natives to inhabit the area surrounding the DBRC worked in logging camps and sawmills. The waters of Hood Canal were used to transport lumber to outside markets. Families arrived by boat to establish farms and ranches on cut-over timberlands. Oyster farms were established on Quilcene Bay in the 1930s and later became a well known industry in the project area (Jefferson County Historical Society 1966:163-167). The Navy built the Whitney Point land-based facility in the mid-1950s. The Zelatched Point land-based facility was built in the mid-1960s by the Navy to replace the Whitney Point land-based facility.

3.8.1.2 Tribal Consultation

The Navy sent letters to the chairs, cultural representatives, and fisheries representatives of each of the Tribal governments representing aboriginal groups with an ethnographically documented presence in Hood Canal. These included the Skokomish Tribe, the Port Gamble S'Klallam Tribe, the Jamestown S'Klallam Tribe, the Lower Elwha Klallam Tribe, and the Suquamish Tribe. The appropriate representatives were determined through preliminary telephone calls to each of the Tribes. Telephone interviews were held with the cultural resource representatives from each Tribe to solicit comments on traditional cultural use areas and areas of cultural importance within the DBRC. Fisheries representatives from each Tribe were also consulted to gather information concerning fisheries resources and activities of economic and social importance. Documentation of Tribal consultation on fisheries is attached separately (see Appendix B, Tribal consultation).

Recent meetings (January 4 and February 8, 2000) with the Skokomish Tribe, Point No Point Treaty Council, and the Jamestown S'Klallam Tribe were held to discuss potential conflicts between Tribal fishing and the Navy's operations in the DBRC. The Navy provided background information on the testing program, and the Tribal members provided information on the timing and location of fishing in the DBRC. The Tribes had some concern that Navy activity would increase in Hood Canal and that was the reason for the preparation of the EA. The Navy explained that the reason for the EA was to analyze the effects of implementing the Operations Management Plan and not an increase in testing activity. Preliminary discussions on establishing a communications protocol between the Navy and the Tribes occurred during the first meeting. After some information exchange following the first meeting, a second meeting was held to refine the communications protocol. A draft protocol was routed to the Tribes and comments were incorporated. The communications protocol is included as a formal mitigation in Section 3.12, Environmental Justice.

Skokomish Tribe

The Cultural Coordinator of the Skokomish Tribe did not have comments pertaining to the DBRC but referred to the written comments in the letter provided by the Skokomish Tribe (Appendix B). The letter stated that Elmendorf (1992) recorded ethnographic place names, village sites, and camping in the DBRC vicinity. The Cultural Coordinator also reported an unrecorded petroglyph on the west shore of Quilcene Bay outside of the

Dabob Bay MOA and six former seasonal fishing camps or villages along the north and south Hood Canal MOAs, but did not know of any additional places of cultural use in the DBRC outside of the recorded ethnographic sites (ROC, Rogers, 1999).

Port Gamble S'Klallam

The Tribal Council Member representative of the Port Gamble S'Klallam Tribe had no comments on cultural places since most of the project area is underwater (ROC, Hebert, 1999).

Jamestown S'Klallam

The Cultural Preservation Specialist of the Jamestown S'Klallam Tribe had concerns about the release of guidance wires that sink to the bottom of the Hood Canal and Dabob Bay. The primary concern was that a build-up of wire deposits could create an environmental hazard that may affect habitat and possibly disturb archaeological resources. An explanation of the size and type of guidance wire used for the tests was provided to the Tribe (ROC, Duncan, 1999).

Lower Elwha Klallam

The Cultural Resource Director for the Lower Elwha Klallam Tribe reported that she had tried to obtain cultural information from Tribal Elders concerning the DBRC, but has not acquired any data. She does not expect additional comments but will call with any new information (ROC, Charles, 1999).

Suquamish

The Tribal Curator of the Suquamish Tribe, stated that according to elder testimony, Suquamish used the area around the Dosewallips River, outside of the Dabob Bay MOA, for seasonal camping (ROC, Sigo, 1999).

3.8.1.3 Conclusions

Review of previous archaeological studies, ethnographic data, and project area landforms indicates a moderate probability for hunter-fisher-gatherer and historic archaeological resources at the Range Control Center at Zelatched Point and the Whitney Point land-based facility and the warning light locations at Zelatched Point, Whitney Point, Pulali Point, Sylopash Point, and the southeast edge of Bolton Peninsula. Previous ground disturbance related to Navy facility construction may have disturbed unknown archaeological resources.

Research indicates the presence of six shipwrecks in the Dabob Bay MOA; five of these within Hood Canal and one within the Dabob Bay MOA. These shipwrecks have not been evaluated for National Register eligibility and their precise locations have not been documented.

3.8.2 Environmental Consequences

3.8.2.1 Preferred Alternative

No archaeological resources or TCPs potentially eligible for listing in the National Register of Historic Places are recorded specifically within the DBRC. No unknown archaeological resources would be affected in the DBRC shoreline access and activity areas because no ground disturbing activities are proposed. In addition, because there is no shoreline activity there would be no effects to Native American traditional cultural use areas or areas of cultural importance.

Shipwrecks possibly eligible for listing in the NRHP exist in underwater areas of the Dabob Bay MOA, the Hood Canal MOA 1 (North), Hood Canal MOA 2 (South), and the connecting waters. The five shipwrecks located in Hood Canal are unlikely to be affected by normal operations within this area, since the Navy has no equipment or operational activities located at the seafloor within Hood Canal. The only aspect of operations that could affect these locations is the occasional weapons retrieval occurrences made necessary when weapons plunge to the bottom. About 14 tests per year must be retrieved from the bottom, and 7 of these require some minor excavation. Rarely (about 1 time in 5 years) test vehicles require more extensive excavation for retrieval. Potential effects to the Orion, the one wreck located in the Dabob Bay MOA, could occur from replacement or installation of acoustical monitoring equipment or related cabling on the seafloor of Dabob Bay, or weapons retrieval, as discussed above. However, there are no current plans to place monitoring equipment or cables on the west side of the Bay.

3.8.2.2 Dabob Bay Limited Alternative

Environmental impacts would be the same as for the Preferred Alternative, with the difference that they would be geographically concentrated within the Dabob Bay MOA. No range testing or proofing operations addressed by the OMP or this EA would occur in Hood Canal under this alternative, eliminating the opportunity for even temporary impacts to cultural resources in the Hood Canal area.

3.8.2.3 No Action Alternative

Environmental impacts would be similar in type as for the Preferred Alternative. Environmental impacts of tests would need to be established by individual testing programs with NUWC Division Keyport. Quantity and type of tests may vary widely from events described in the Preferred Alternative, as impacts would depend on test program parameters established for each independent program.

3.8.3 Mitigation Measures

When weapon recovery or the replacement or installation of acoustical monitoring equipment or related cabling will require bottom-disturbing activities within one mile (1.6 km) of a known shipwreck site, the Navy will conduct a reconnaissance of the area to determine if the shipwreck is located within the area to be disturbed. In the event that the shipwreck is within the area to be affected by the proposed operation, the Navy will consult with the State Historic Preservation Officer (SHPO) to determine if the action may proceed as planned, or what modifications to the action may be needed. In accord with the Protection of Historic and Cultural Properties (36 CFR 800), Protection of Archeological Resources: Uniform Regulations (32 CFR 229), State Historic Preservation Office Regulations, Indian Sacred Sites Executive Order 13007, and Consultation and Coordination with Indian Tribal Governments Executive Order 13084 indicates that no further mitigation measures are required.

3.9 LAND AND SHORELINE USE

As Hood Canal is the boundary between Jefferson and Kitsap counties, the project area encompasses both counties. Land and shoreline use for Jefferson and Kitsap counties are summarized below. Analysis of land and shoreline use focused on consistency with state and local statutes.

Pursuant to the Coastal Zone Management Act Navy must comply with the Shoreline Management Act (SMA) to the maximum extent practicable. The SMA is implemented through county management plans. The Navy prepared a consistency determination as required by the federal implementing regulations. The Washington State Department of Ecology submitted a letter on 10 December 2001 stating that they agree with Navy's determination that the proposed action is consistent to the maximum extent practicable with the enforceable policies of Washington's Coastal Zone Management Program. A copy of the Coastal Consistency Determination and Washington State Department of Ecology letter can be found in Appendix E.

3.9.1 Affected Environment

3.9.1.1 Jefferson County

The study area in Jefferson County consists of the shoreline adjacent to Hood Canal and Dabob Bay, a largely rural environment. The only settlements in the area consist of two small towns—Quilcene, a small fishing village at the head of Quilcene Bay separated from Dabob Bay by the Bolton Peninsula, and Brinnon, a rural hamlet at the mouth of the Dosewallips River across Dabob Bay from Zelatched Point. With these exceptions, existing land uses along the shoreline and on the Toandos Peninsula consist of public timberlands, private timberlands, and rural residential lots. Of the latter, perhaps half contain residential improvements (Jefferson County 1998). In addition, there is a large tract of Navy land along the eastern shoreline of the Toandos Peninsula that is owned by SUBASE Bangor. Except for shorelands and lands along the level river valleys, the majority of land on the west side of Dabob and Quilcene bays consists of state and national forestland. Population densities throughout most of this area are less than 1 person per every 15 acres (6 ha), with some areas where densities increase to 1 person per every 5 to 10 acres (2 to 4 ha) (Jefferson County 1998). In three limited areas, population densities increase to 1 person per acre (0.4 ha) or greater. These areas are the town of Quilcene, the Dosewallips River valley near Brinnon, and near the mouth of the Duckabush River south of Dabob Bay.

The majority of ownership parcels in the vicinity of Dabob Bay, including the Toandos Peninsula, the Bolton Peninsula, and lands between the west shore of Dabob/Quilcene Bays and the Olympic National Forest, are designated as Long-Term Resource Areas in the Jefferson County Comprehensive Plan (Jefferson County 1998). These parcels are zoned either Rural Forest (minimal parcel size = 40 acres [16 ha]), Commercial Forest (minimal parcel size = 80 acres [32 ha]), or Inholding Forest. The predominant zoning designation for the remaining parcels is Rural Residential, at residential densities varying between 1 dwelling unit (DU) per 5 acres (2 ha) to 1 DU per 20 acres (8 ha). Several parcels have been designated as Parks, Preserves, and Recreation, including Dosewallips State Park, two areas on Whitney Point, and an area just north of the mouth of the Duckabush River, all on the west shore of Dabob Bay. One parcel has been designated as Commercial Agriculture immediately east of Quilcene, at the mouth of the Little Quilcene River. There are no Urban Growth Areas (UGAs), as defined in accordance with the State of Washington's Growth Management Act (GMA) (RCW 36.70A), near the study area, although Quilcene and Brinnon are designated as Rural Village Centers (RVCs). These RVCs contain commercial areas.

3.9.1.2 Kitsap County

In Kitsap County, the study area for land use is defined by a narrow corridor consisting of ownership parcels abutting either side of State Route (SR) 308 between the front gates of NUWC Division Keyport and SUBASE Bangor, a distance of approximately 3 miles (4.8 km). This study area encompasses potential impacts to land use related to testing at the DBRC, principally due to the vehicle traffic between the two military installations. The study area is outside of Kitsap County's designated UGA. As a consequence, this area will experience lower growth and residential densities, as urban services such as sewer and water are not provided outside of UGAs or other special districts.

Kitsap County has a 5-tiered classification system for ranking roadways (Kitsap County 1998). Roads are designated as Principal Arterial, Minor Arterial, Collector, Minor Collector, or local roadway, in descending order of traffic speed and volume. Highway 308 is designated as a collector route by the County a designation that establishes an expectation of lower volumes and speeds than does that of principal arterial or minor arterial. The legal speed limit for collector routes in Kitsap County is 50 miles per hour (80.5 kilometers per hour).

Existing land uses in this corridor consist principally of rural density single-family housing, a small commercial crossroads, a major transportation arterial right-of-way (SR 308 crosses under SR 3), and resource lands. The Kitsap County Comprehensive Plan (Kitsap County 1998) identifies 4 land use designations within this corridor: Rural Protection (1 DU/10 acres [4 ha]), Rural Residential (1 DU/5 acres [2 ha]), Industrial, and Neighborhood Commercial. Parcels on either side of the highway from the Keyport front gate to Scandia Way, approximately halfway to the SUBASE Bangor gate, are designated Rural Protection. From there, land on the north side of SR 308 is designated as Rural Residential, while parcels south of the road are designated as Rural Protection, except a small area of Rural Residential between the intersections with Viking Way and Scandia Way. Small areas of Industrial and Neighborhood Commercial are designated at the intersection with Viking Way.

Marine Environment

The DBRC analyzed in this document encompasses 3 different testing areas in the waters of Dabob Bay and Hood Canal. The Dabob Bay MOA encompasses the greater area of Dabob Bay, while there are two MOAs in Hood Canal adjacent to SUBASE Bangor. These testing areas are identified as Naval Operations Area on the pertinent NOAA navigation maps. The Navy has jurisdiction over vessel traffic in the Operations Areas. This jurisdiction is granted by Section 334.1190 of Chapter 2, U.S. Coast Pilot 7.

3.9.2 Environmental Consequences

3.9.2.1 Preferred Alternative

Jefferson County

While growth in the Jefferson County area is expected to be high in terms of current levels, population densities are expected to remain very low in absolute terms. Conflicts arising as a consequence of growth and development are not expected. No construction of new facilities or substantial improvements/alterations to existing facilities are planned as part of the Proposed Action. Increase of operational tempo over 1997 levels is not planned, so no increase to traffic on state or local roads is anticipated. Noise impacts and safety impacts are discussed in Section 3.7 and 3.13, respectively. No significant adverse impacts to land use in Jefferson County are expected due to the OMP.

Kitsap County

Growth in the SR 308 corridor is expected to remain low due to current County long-range planning, so conflicts arising as a consequence of growth and development are not expected. Overland vehicle traffic to Zelatched Point by way of SR 308, SR 3, SR 104, and Coyle Road is expected to remain at current low levels and will consist mostly of passenger vehicles. Trucks bearing test units will primarily travel the SR 308 corridor. Increase of operational tempo over 1997 levels is not planned, so no increase to traffic on state or local roads is anticipated. Noise impacts and safety impacts are discussed in Section 3.7 and 3.13, respectively. No significant adverse impacts to land use in Kitsap County are expected due to the OMP.

3.9.2.2 Dabob Bay Limited Alternative

Environmental impacts would be the same as for the Preferred Alternative, with the difference that they would be geographically concentrated within the Dabob Bay MOA.

3.9.2.3 No Action Alternative

Environmental impacts would be similar in type as for the Preferred Alternative. Environmental impacts of tests would need to be established by individual testing programs with NUWC Division Keyport. Quantity and type of tests may vary widely from events described in the Preferred Alternative, as impacts would depend on test program parameters established for each independent program.

3.9.3 Mitigation Measures

No significant impacts, when compared against local and federal standards, are anticipated relative to land and shoreline use. Therefore, no mitigation measures are required or proposed.

3.10 SOCIOECONOMICS

This section reviews Navy operations at the DBRC in relation to potential socioeconomic impacts.

3.10.1 Affected Environment

3.10.1.1 Population

Jefferson County population for 1995 was estimated as 25,754 residents. Population densities in the area of Dabob Bay are very low, averaging less than 1 resident per 10 acres (4 ha) over most of the area (Jefferson County 1998).

The Office of Financial Management has estimated Kitsap County's 1995 population at 220,600 (Access Washington 1999) ranking it 6th largest of Washington's 39 counties. With an area covering only 396 square miles (1,025 km^2), Kitsap County's population density stands at 557 people per square mile (1,442 km^2), making it the second most densely populated county in the state. In the last 25 five years, Kitsap County's population has increased 116.8

percent. The state's population, by comparison, rose 59.1 percent. In the first three years of this period, Kitsap County had only a negligible increase. Starting in 1974, however, significant population growth began. Over this period the population has steadily grown, with increases ranging from 0.6 to 9.6 percent per year.

3.10.1.2 Employment

Jefferson County's major economic sectors have historically been dominated by resource-based activities such as fishing, aquaculture, and forestry. In recent years there are signs of diversification to include manufacturing and marine trades. In addition, there is tremendous growth in the services sector (Jefferson County 1998). Most of this growth has occurred in the northern part of the county.

Kitsap County's economy is dominated by the federal government. Between the active duty military and federal civilian employees, a very large portion of the county is supported by government spending. Large portions of the healthy trade and services sectors owe their existence to the federal presence. The construction and services sectors, however, were close to statewide averages. Agriculture and manufacturing do not occupy a large part of the regional economy, indicating a high level of importation (most of the ship repair work at the Puget Sound Naval Shipyard in Bremerton could be considered manufacturing but it is categorized as government employment).

3.10.1.3 Income

Real wages in Jefferson County have been falling over the past two decades. Although nominal wages have increased from $7,175 to $16,733 between 1969 and 1989, real wages have fallen 27 percent from $24,933 to $18,036 over the same time period. The decline may be a reflection of the relative increase of jobs in the retail and service sectors. However, the real per capita income has been increasing steadily over the last few years. The average annual wages in Jefferson County are well below the state average at $19,034 versus state wages of $27,446 (Jefferson County 1998).

Kitsap County's annual average civilian wage in 1994 was $25,094, the sixth highest among Washington's 39 counties. (The highest wage, $30,176, was found in King County; the lowest, $15,596, was in Douglas County.) The higher average wages can be traced to federal government employment. The county's 1994 average wage in private employment was $19,243; in public employment, $33,856 (Access Washington 1999).

In comparison to the statewide average, wages in Kitsap County have not fared well over time. Throughout the 1970s, Kitsap County's wage remained well above the statewide average; however, beginning in 1978, the averages for both began falling and the county's wage fell at a faster rate than the state's. In 1980 the wage in Kitsap County fell below the state's and it has remained there since (except for two years during the recessions of the early

1980s). In 1994, the state's average was $1,300 higher than the county's average income (Access Washington 1999).

3.10.2 Environmental Consequences

3.10.2.1 Preferred Alternative

The Proposed Action is not expected to have any socioeconomic impact on Jefferson or Kitsap counties. No employment or population growth is expected as a consequence of the Proposed Action.

3.10.2.2 Dabob Bay Limited Alternative

Socioeconomic impacts would be the same as for the Preferred Alternative, with the difference that they would be geographically concentrated within the Dabob Bay MOA.

3.10.2.3 No Action Alternative

Socioeconomic impacts would be similar in type as for the Preferred Alternative. Environmental impacts of tests would need to be established by individual testing programs with NUWC Division Keyport. Quantity and type of tests may vary widely from events described in the Preferred Alternative, as impacts would depend on test program parameters established for each independent program.

3.10.3 Mitigation Measures

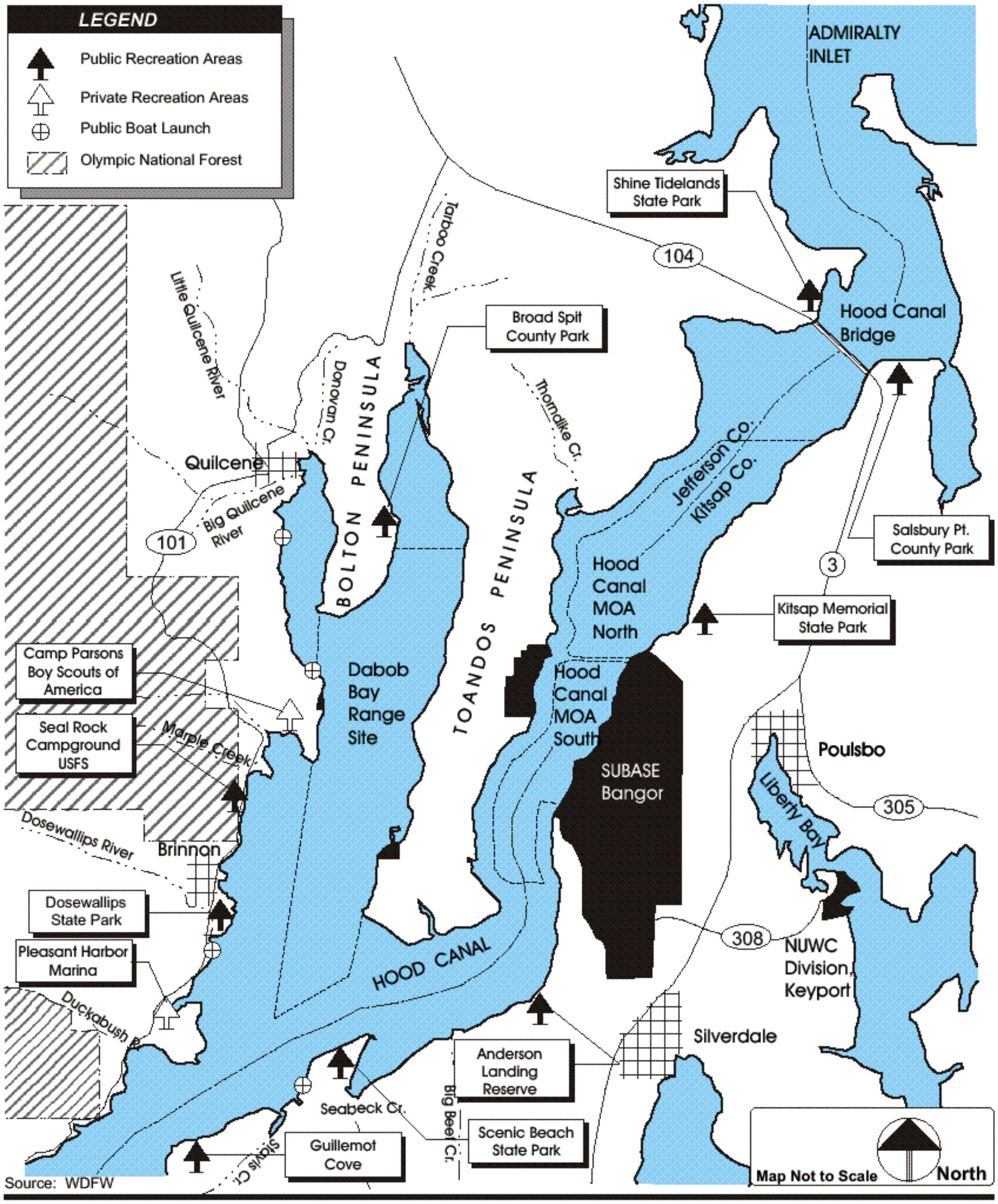
Based on the analysis presented above, no significant impacts to socioeconomics are anticipated under the Proposed Action. Therefore, no mitigation measures are required or proposed.

3.11 RECREATION

This section reviews DBRC operations in relation to potential recreational impacts.

3.11.1 Affected Environment

The land-based recreation facilities in the vicinity of the DBRC include county facilities, state parks, and national forest campgrounds (Figure 3.11-1). Water-based recreation activities are most likely to be affected by Navy activities under the Preferred Alternative.



Environmental Assessment for the
Dabob Bay Operations and Management Plan
NUWC Division Keyport

Recreation Facilities in Vicinity of the Dabob Bay / Hood Canal MOAs

Figure 3.11-1

In addition to typical water-based activities such as swimming and boating, Dabob Bay/Hood Canal has an active shrimping season typically commencing the third Saturday in May and continuing every Wednesday and Saturday for two weeks. This four-day season is an extremely popular regional activity and stimulates heavy boating traffic. The actual length of the season is determined by a pre-evaluation of the health of local shrimp population conducted annually by the Point Whitney Shellfish Lab (ROC, Wood, 1999). A Tribal shrimp fishery is open prior to and following the recreation fishing.

3.11.1.1 Jefferson County

There are several recreation areas in the project site vicinity, listed and described below.

Broad Spit Park is a 44-acre (17.8 ha) county facility located on the eastern edge of the Bolton Peninsula, at the north end of the Dabob Bay MOA. It is an open space park with saltwater access only and an undeveloped beach front.

Dosewallips State Park is located one mile (1.6 km) south of Brinnon and 40 miles (64 km) north of Shelton on the western shore of Hood Canal, at the mouth of Dabob Bay. It is comprised of 425 acres (172 ha) and 5,500 feet (1,676 m) of saltwater shoreline on Hood Canal and 5,400 feet (1,645 m) of freshwater frontage on both sides of the Dosewallips River. Facilities at the park include 35 picnic sites, 88 standard sites, 40 trailer sites, 2 primitive sites, 1 group camp, parking for 60 vehicles, comfort stations, 2 picnic shelters, and 4 miles (6.4 km) of trails. There is also a boat launch ramp. Activities at the park include picnicking, hiking, fishing, oyster picking and clamming (when water quality conditions permit), camping, shrimping, and wildlife watching.

Pleasant Harbor State Park is a satellite park to Dosewallips State Park and is located 2 miles south of Brinnon. Activities include beachcombing, fishing, motor boating, and scuba diving. It is a marine moorage facility only.

Shine Tidelands State Park is located just north of the Hood Canal Bridge on the Olympic Peninsula (west end), off of Highway 104. The park consists of 13 acres (5.3 ha), most of which is wetlands, and 5,062 feet (1,542 m) of tidelands. Facilities at the park include a parking area, 18 primitive campsites, camp pay station and two information boards. Portable chemical toilets are available seasonally from April 1 to October 31. The area receives heavy seasonal use by clam diggers and crabbers. Other popular activities are beachcombing, hiking, camping, skin diving, and wind surfing. Seal Rock National Forest campground is located on the eastern edge of the Olympic Peninsula, just north of Brinnon. The park has salt water frontage and provides basic camping facilities but no boat launching.

Camp Parsons is a facility owned and operated by the Boy Scouts of America, located just south of Whitney Point on approximately 240 acres (97 ha) with full camp facilities, including barracks, water facilities, etc.

Additional facilities include the Port of Port Townsend's public boat launch ramp just south of Quilcene, and the public boat launch site on Whitney Point at the Whitney Point Fisheries Lab.

3.11.1.2 Kitsap County

Recreation facilities in Kitsap County adjacent to Hood Canal are listed and described below.

Kitsap Memorial State Park is on SR 3, about 3 miles (4.8 km) south of the Hood Canal Bridge on the Kitsap Peninsula in Kitsap County. The park is 58 acres (23 ha) with 1,797 feet (548 m) of saltwater frontage. Facilities at the park include 2 shelters, a meeting hall, 25 standard campsites, 18 campsites with water and electrical hookups, 3 primitive campsites for hikers or bicyclists, a group camp with 2 Adirondack shelters, 51 picnic sites, an unguarded beach, and 1 mile (1.6 km) of foot trails. Activities at the park include camping, picnicking, hiking, volleyball, fishing, marine recreation, oyster and clam harvesting, and group gatherings.

Scenic Beach State Park is located in Kitsap County, 12 miles northwest (19 km) of Bremerton, 1 mile (1.6 km) southwest of Seabeck on Hood Canal. The park is located on 88 acres (36 ha) with 1,487 feet (453 m) of saltwater frontage. Facilities at the park include day use area with 75 picnic sites, a kitchen shelter, comfort stations, parking for 75 cars, camping area with 52 tent or trailer sites, seasonal ranger quarters, 1,487 feet (453 m) of unguarded beach, and a primitive group camp with shelter. Activities at the park include picnicking, camping, hiking, boating, fishing, and oysters in season.

Salisbury Point is a 6.5-acre (2.6 ha) county park with boat launch facilities located a short distance north of the Hood Canal Bridge, near the entrance to Port Gamble Bay. Anderson Landing Reserve is a 127-acre (51 ha) tract of county open space land across from the mouth of the Duckabush River. A public boat launch facility is located at Stavis Bay one mile (1.6 km) south of Scenic Beach State Park.

3.11.2 Environmental Consequences

3.11.2.1 Preferred Alternative

The impact of the Proposed Action on the recreation facilities is expected to be minimal. Naval activities associated with the Preferred Alternative are in deep water and not directly along the shoreline where most recreation facilities are located. Naval vessels operate under the same Coast Guard regulations as do other boaters. The potential exists to affect commercial, tribal, and private boaters during shrimping season due to the heavy demand and the short season. This is predominantly a recreational fishery. It is NUWC Division Keyport's practice to curtail testing operations in Dabob Bay during shrimping season due to the high volume of boaters in the area at that time. It is impractical for the Navy to continue testing at that time, as the potential for boater conflict is too great; also, the amount of boating traffic results in background motor noise levels that interfere with acquisition of acoustically monitored test data.

3.11.2.2 Dabob Bay Limited Alternative

Environmental impacts would be the same as for the Preferred Alternative, with the difference that they would be geographically concentrated within the Dabob Bay MOA. No range testing or proofing operations addressed in the OMP and this assessment would occur in Hood Canal under this alternative, eliminating the opportunity for even transient conflicts with recreational boaters in the Hood Canal area.

3.11.2.3 No Action Alternative

Environmental impacts would be similar in type as for the Preferred Alternative. Environmental impacts of tests would need to be established by individual testing programs with NUWC Division Keyport. Quantity and type of tests may vary widely from events described in the Preferred Alternative, as impacts would depend on test program parameters established for each independent program.

3.11.3 Mitigation Measures

Based on the analysis, no significant impacts to recreation resources are anticipated under the Proposed Action. Therefore, no mitigation measures are required or proposed.

3.12 ENVIRONMENTAL JUSTICE

This section reviews the DBRC operations in relation to Executive Order 12898. The analysis indicates that the Navy is in compliance with this Executive Order.

3.12.1 Affected Environment

In February 1994, the President issued Executive Order 12898 that requires all federal agencies to seek to achieve environmental justice by "identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (Executive Order 12898). The DoD followed in March 1995 with its Strategy on Environmental Justice to meet the intent of Executive Order 12898, which the EPA approved in April 1995. The Department of the Navy has established policies and assigned responsibilities with the goal of preventing disproportionately high and adverse human or environmental effects on minority and low-income populations. The strategy states that DoD will use NEPA as the primary mechanism to implement the provisions of the Executive Order. The

Department of the Navy will distribute this EA to state and local government, local Tribes, and other organizations so that possible concerns about the potential impacts of the Proposed Action can be expressed.

The area of influence for the environmental justice section is defined as those census tracts bordering on the shores of Dabob Bay and the central Hood Canal area, as well as the census tracts that include NUWC Division Keyport and/or lie between Keyport and SUBASE Bangor. These include census tracts 9502 and 9503 in Jefferson County, and census tracts 0902, 0903, 0904, 0911, 091202, and 0913 in Kitsap County. These Jefferson and Kitsap county census tracts exhibit a lower or similar percentage of racial and ethnic minorities than Washington State as a whole, depending on the minority group. Compared to the nation as a whole, these county census tracts have a lower percentage of Blacks and persons classified as “Other,” as well as a lower percentage of persons of Hispanic origin. The Kitsap County tracts do, however, have a higher percentage of Native Americans and Asians/Pacific Islanders than the nation as a whole, while the Jefferson County census tracts have a higher percentage of Native Americans than the nation, as shown in Table 3.12-1.

The Lower Elwa, Port Gamble, and Jamestown S’Klallam Tribes, and the Skokomish Tribe have primary fishing rights on Dabob Bay and Hood Canal as part of their ‘usual and accustomed fishing places’ rights established by the Point No Point Treaty. The Suquamish Tribe has secondary rights (i.e., they may fish only by invitation from the Tribe with primary rights[1]). These Tribes fish regularly in the area of operations for salmon, geoduck, crab, shrimp, and shellfish. In particular, there are rich beds of shellfish along the shores of Dabob Bay and Hood Canal that form the basis for important tribal fisheries.

Representatives from NUWC Division Keyport have met with representatives of the affected Tribes and the Point No Point Treaty Council to establish points of contact to exchange information (testing activity and Tribal fishing plans) to avoid disruption of Tribal fishing patterns. Details of the two meetings can be found in Appendix B. The meetings resulted in an agreement to exchange information between NUWC Division Keyport, the Skokomish Tribe, Jamestown S'Klallam, Port Gamble S'Klallam, Lower Elwha Klallam, and Point No Point Treaty Council. This agreement has been formalized as mitigation to the Preferred Alternative (Section 3.12.3).

[1] United States of America, Plaintiff and Quinault Indian Tribe et al., Plaintiffs-Intervenors and The Suquamish Indian Tribe, Plaintiff-Intervenor-Appellant v. The Skokomish Indian Tribe, Plaintiff-Intervenor-Appellee v. State of Washington et al. Defendants No. 84-3894 United States Court of Appeals Ninth Circuit Argued and Submitted April 2, 1985. Decided June 25, 1985.

Table 3.12-1: Minority Populations in selected census tracts in Jefferson and Kitsap County.

Race/ Ethnicity	Jefferson County Census Tracts		Kitsap County Census Tracts		Washington State		United States	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
White	5,465	97.2 percent	25,430	91.6 percent	4,308,937	88.5 percent	199,686,070	80.3 percent
Black	16	0.3 percent	51.9	1.9 percent	149,801	3.1 percent	29,986,060	12.1 percent
Native American	90	1.6 percent	303	1.1 percent	81,483	1.7 percent	1,959,234	0.8 percent
Asian/ Pacific Islander	42	0.7 percent	1,214	4.4 percent	210,958	4.3 percent	7,273,662	2.9 percent
Other	12	0.2 percent	276	1.0 percent	115,513	2.4 percent	9,804,847	3.9 percent
Total	5,625	100 percent	27,772	100 percent	4,866,692	100.0 percent	266,490,000	100.0 percent
Hispanic (any race)	55	1.0 percent	879	3.2 percent	214,570	4.4 percent	22,354,059	9.0 percent

Source: U.S. Bureau of the Census 1990

3.12.2 Environmental Consequences

3.12.2.1 Preferred Alternative

In general, the Proposed Action would not have a significant adverse impact on minority or low income communities due to the operational nature of the action. No significant increases in pollution or health risks are anticipated as a result of the project.

The Preferred Alternative could potentially disrupt Tribal fishing patterns in Dabob Bay, depending on the frequency and nature of the operations. For example, requiring boats to halt for testing in the middle of setting nets could disrupt fishing patterns. However, testing patterns over the years have not resulted in significant disruption of fishing. The Dabob Bay MOA is primarily used by the Tribes for shellfishing. The Tribes transit Dabob Bay to reach Quilcene Bay for other fisheries. There has been no record of damaged fishing equipment from operations described under the DBRC OMP. Scheduling of testing have been coordinated with Tribal fishing patterns to ensure that the potential for disruption is minimized (see Appendix B).

3.12.2.2 Dabob Limited Alternative

Environmental impacts would be the same as for the Preferred Alternative, with the difference that they would be geographically concentrated within the Dabob Bay MOA. No range testing or proofing operations addressed in the OMP or this EA would occur in Hood Canal under this alternative, eliminating the potential for conflicts with Tribal fisheries in the Hood Canal area.

3.12.2.3 No Action Alternative

Environmental impacts would be similar in type as for the Preferred Alternative. Environmental impacts of tests would need to be established by individual testing programs with NUWC Division Keyport. Quantity and type of tests may vary widely from events described in the Preferred Alternative, as impacts would depend on test program parameters established for each independent program.

3.12.3 Mitigation Measures

Consultation with the representatives from the affected Tribes and Point No Point Treaty Council resulted in the following agreement to exchange information. NUWC Division Keyport provides a weekly schedule of the scheduled range activity for the DBRC. The schedule distinguishes activity on the range tracking area of Dabob Bay and the Hood Canal. As part of this activity report there is an estimated range usage time (half day / all day). This schedule is sent to the points of contact (POCs) established during consultation via electronic mail (email). Any significant emergent changes/updates to this schedule will be sent to the POCs via email as they may occur. The affected Tribes provide a copy of the Annual Regulations for the various Tribal fisheries via the Point No Point Treaty Council to the NUWC Division Keyport POCs. The Point No Point Treaty Council also notifies the NUWC Division Keyport POCs of any emergency regulations that are made during the year.

NUWC Division Keyport will continue to meet with the Tribal representatives as requested. No additional mitigation measures are needed or proposed.

3.13 PUBLIC SAFETY HAZARDS & ENVIRONMENTAL HAZARDS TO CHILDREN

This section addresses potential public safety hazards and environmental health hazards to children associated with the various alternatives.

Executive Order 13045, dated April 21, 1997, requires that federal agencies "shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children; and shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks." The only issues requiring discussion of the potential for disproportionate effects on children are noise and hazardous materials. The analysis below shows that the Navy is in compliance with local and federal regulations for each of these areas.

3.13.1 Affected Environment

The majority of testing activities related to the Proposed Action are restricted to the waters of Hood Canal and Dabob Bay. Areas of onshore activity are concentrated within specific areas within military bases with restricted access, principally the K/B docks at SUBASE Bangor, the pier at Point Zelatched, the flight line at NASWI, and the industrial area of NUWC Division Keyport. Children are not allowed near these areas, except perhaps as part of specific tours during which special safety precautions are taken.

Overland travel of testing units likewise represents no threat to public safety. Testing units are typically transported by truck over designated arterials. The volumes of truck traffic generated are low, less than one test per day. A typical test in Dabob Bay would generate a total of four truck trips over the 4 miles (6.4 km) of public arterial between Keyport and SUBASE Bangor, with a delivery trip there and back in the morning and a pick-up trip there and back at the end of the day. Trucks also transport test units to either Zelatched Point or NASWI at infrequent intervals, averaging between 10 and 20 test events per year.

Testing operations affecting upland areas outside of military installation fencelines are limited to overland transportation routes between NUWC Division Keyport and testing facilities. SR 308 between Keyport and SUBASE Bangor is the principal route used by Keyport testing operations, a distance of approximately 4 miles (6.4 km). There are five intersections in these 4 miles (6.4 km), one of which has a stoplight. SR 308 is the dominant road at all intersections. Test units also travel overland by truck to Zelatched Point or NASWI at infrequent intervals. When traveling overland to Zelatched Point, the only truck route is SR 308 north to SR 3, then west on SR 104 across the Hood Canal Bridge, then south on Coyle Point Road to Zelatched Point. Trucks traveling to NASWI cross the Sound by ferry and travel north on I-5 unless they are transporting SCEPS-powered units, such as the MK-50 torpedo, in which case they take the Tacoma Narrows Bridge.

Pearson Elementary School is located on the southeastern side of the intersection of Central Valley Road and SR 308. There are approximately 370 students enrolled in the K-6 school. The school faces Central Valley Road with a gym, blacktop area, and the lower playfield located to the north side of the building, between the classroom buildings and SR 308. The lower playfield is on a downward slope from the blacktop to the SR 308. Also, the playfield is located approximately 10 yards (9.1 m) from SR 308 and contains a baseball diamond, a soccer field, and a wooded tree area which directly faces the road. Road noise has not been a problem in the classrooms to date, as they are relatively buffered from SR 308. Outside noise levels at the lower playfield have not been significant with normal traffic.

3.13.2 Environmental Consequences

3.13.2.1 Preferred Alternative

Implementation of the Proposed Action is not anticipated to have any significant adverse impacts to public safety, including safety to children. As stated, the majority of the activity related to the Proposed Action occurs in marine waters. Children are present in vicinity of the test site only on boats under adult supervision. Testing in marine waters takes place in specific identified MOAs, clearly marked on all NOAA charts. Boating activity within these areas is subject to special regulations. In Dabob Bay, furthermore, it is regulated by a series of shore signals that communicate testing status and can signal boats to come to a stop during tests. However, vessels are generally requested to come to a stop to prevent engine noise from interfering with test data recording rather than for safety reasons.

Testing units typically travel at depths of 20 feet (6.1 m) or greater, depths that represent no threat to surface vessels. They are equipped with redundant safety features programmed to shutdown test units should they malfunction and rise to a preset depth. This cutoff feature prevents units from striking vessels or running on-shore. The principal danger to civilians during testing is due to a collision between a Naval vessel and a civilian craft, an unlikely event given the low density of boating traffic and the controlled speeds at which testing takes place. Testing is generally conducted on weekdays during daylight hours, whereas high levels of civilian boating traffic typically occur on summer holidays and weekends. Navy testing is often curtailed during shrimp season when large volumes of civilian vessels are present. All Navy vessels comply with U.S. Coast Guard rules regarding maritime traffic and safety.

Explosive warheads are never placed on test units, nor do they contain fuels that would be capable of exploding under conditions encountered in daily situations. Even a high-speed crash would be unlikely to produce a fuel spill from a test unit, due to hull strength. SCEPS units are double hulled, as the chemical boiler is within a separate container inside the torpedo wall. Trucks are labeled with appropriate hazardous materials markers (49 CFR Parts 100-185). There has been only one accident involving NUWC Division Keyport vehicles on public roads in 20 years, either to Bangor, NASWI, or elsewhere. The accident involved a truck transporting a testing unit to SUBASE Bangor on SR 308 being struck by a civilian car, and was fatal to the driver of the car, who had run a stop sign and struck the truck.

All pilots of fixed-wing aircraft and helicopters that are part of DBRC testing are given a pre-flight briefing on the potential hazards and conditions of the vicinity according to standard Navy fight protocols. This includes a discussion of the standard approach and departure routes for the test area and for the Zelatched Point helicopter landing site.

The scenario used for this analysis assumed the entire contents of one MK 50 torpedo was released into the atmosphere over less than 15 seconds. This would result in the largest concentration of sulfur hexafluoride possible from the rupture of a single torpedo. The Occupation Safety and Health Administration (OSHA) has established a permissible exposure limit of 1,000 ppm (5,970 mg/m^3) averaged over an 8-hour period. The results of the screening indicated that the maximum hourly concentration would be approximately 16 ppm (94 mg/m^3), or less than 1 percent of the workplace exposure standard imposed by OSHA. No further analysis was conducted. Screening using EPA-approved modeling found no potential for hazard to the public or operations personnel due to toxicity of sulfur hexafluoride.

3.13.2.2 Dabob Bay Limited Alternative

Environmental impacts would be the same as for the Preferred Alternative, with the difference that they would be geographically concentrated within the Dabob Bay MOA.

3.13.2.3 No Action Alternative

Environmental impacts would be similar in type as for the Preferred Alternative. Environmental impacts of tests would need to be established by individual testing programs with NUWC Division Keyport. Quantity and type of tests may vary widely from events described in the Preferred Alternative, as impacts would depend on test program parameters established for each independent program.

3.13.3 Mitigation Measures

No significant impacts as measured against Executive Order 13045 are anticipated. This is based upon the analysis of DBRC operations and their potential consequences against these standards. Therefore, no mitigation measures are proposed or required.

4.0 CUMULATIVE AND LONG-TERM EFFECTS

This section summarizes cumulative and long-term environmental impacts identified for each of the alternatives. Cumulative impacts are those that result from the incremental consequences of an action when added to past, present, and reasonable foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. The effects of a specific action may be undetectable but when considered in conjunction with other actions, or other incremental effects, can lead to a measurable environmental impact. Long-term impacts are those caused by an action, but the results may appear later in time or farther removed in distance but are still reasonably foreseeable.

4.1 CUMULATIVE EFFECTS

The following cumulative effects related to testing of underwater weapons as proposed by the Dabob Bay OMP are discussed in terms of: (1) regional growth, and (2) federal actions in the vicinity of the Proposed Action.

4.1.1 Regional Growth

The greater Puget Sound region is experiencing a rapid rate of overall population and economic growth. Recreational boating use of the waters of Puget Sound is experiencing a concomitant rise in activity. However, in contrast to other areas of Puget Sound, the U.S. Coast Guard does not monitor vessel traffic in Hood Canal because the relatively low level of commercial vessel traffic does not require traffic control. Therefore, the Coast Guard does not have data on the level of commercial or recreation traffic in the project area. While data on recreation use of the DBRC are lacking, information from WDFW on the extent of recreation shrimp fishing in the vicinity of the DBRC provides some insight to use of the area. During the 1999 recreation shrimp fishery, WDFW counted fishing boats using Dabob Bay and areas of Hood Canal that roughly correspond to the DBRC. Between May 15 and June 2, 1999 the five days of survey indicated a range of between 221 and 743 boats. The average was 498 boats observed per survey day (ROC, Cain, WDFW 1999). Tribal shrimp fishing usually occurs for two weeks in early May, and then from mid June to as late as October. Conflicts between recreational boaters and Navy testing could increase as a consequence of growth in the years ahead. This will be minimized by the Navy testing schedule, which typically occurs Monday through Friday during daylight hours., while peak recreational boating activity occurs on weekends and holidays. While recreational boating and fishing are increasing, the combined levels of these with Navy activities in the DBRC would remain less than the levels of activity in other more densely settled areas of Puget Sound. Thus, the cumulative effect on environmental resources is not significant.

4.1.2 Other Federal Actions

Other federal actions in the Hood Canal and Dabob Bay environment are primarily related to SUBASE Bangor, located adjacent to Hood Canal. Currently, submarines operating from SUBASE Bangor transit the Hood Canal within the MOA areas 150 days per year (ROC, Brooks, 2000). Other vessel traffic from Bangor operations is approximately 25-30 small craft/support vessels per month. The military mission at SUBASE Bangor is expected to remain constant or decrease slightly in intensity for the foreseeable future (Department of the Navy 1998).

Similarly, activity associated with the DBRC is not expected to increase in intensity or operational tempo in the foreseeable future. Thus, cumulative effects of Navy activities within the DBRC on environmental resources are not significant.

4.2 LONG-TERM EFFECTS

This section addresses the potential long-term effects of chemicals and materials released into the Dabob Bay and Hood Canal MOAs, as described in Chapter 3.0. Chemical propellant byproducts released into the waters of Dabob Bay are either harmless or do not accumulate in sufficient concentrations to affect water quality. Similarly, these byproducts would disperse over time and space, and would not accumulate in high enough concentrations to significantly affect water quality or contaminate the sediments.

Materials are released into marine waters during the course of testing that are not recovered. These materials sink to the bottom where they accumulate, as summarized by the following:

- An estimated maximum of 4,925 lbs (2,289 kg) of plastic-coated copper guide wires are released into the Dabob Bay environment annually, where they accumulate in the bottom sediments. On average, each wire is 43,000 feet (13,115 m) long, 0.039 inches (1.0 mm) in diameter, and contains 55 lbs (25 kg) of copper. Attempts to recover these wires have failed because the wires are fragile and they typically break after about 30 feet (9.1 m) of wire is pulled up. Heavier wires that might be recoverable cannot be used because the wires need to be thin to fit on the spool inside the torpedo. These wires will continue to accumulate at a rate directly linked to the testing rate of those test units, which are capped by the event ceiling specified in Table 2.3-2, an estimate of 90 events annually. In actual practice, annual testing rate is typically less.
- Other hardware related to air-borne test unit launching consist principally of parachutes and harnesses including a 6-lb (2.7 kg) aluminum alloy attachment and 4.3 square yards (3.6 m^2) of nylon. These inert materials, such as plastics, nylon, aluminum, and ferrous metals, are released and

become part of the bottom debris. An estimate of 10 air launches per year may be conducted, although the average annual rate is expected to be less.

- It is estimated that 20 acoustic listening devices, known as sonobuoys, are released annually. Attempts to recover sonobuoys from the water surface are usually successful but depend on sea and weather conditions.
- Electronic countermeasure devices, 3-5 inches (7.6 to 12.7 cm) in diameter and 2-6 ft (0.6 to 1.8 m) long, are released into the range waters where they sink to the bottom and are buried in the bottom sediments. These devices include batteries and electronics systems as well as the body. It is estimated that 50 of these devices are released per year.
- 6000-lb (2,727 kg) diamond-shaped lead anchors have periodically been lost in the bottom sediments, creating a point source of pure elemental lead contaminating bottom sediments at that location. Every effort is made to recover them when the buoys are removed from the range. It is estimated that 40 small (13 lbs [5.9 kg] each) lead dropper weights will be released each year during the lightweight torpedo testing programs. These weights are coated with cadmium on one side.

Torpedo testing has been carried out in Dabob Bay for at least 50 years resulting in the accumulation of an unknown quantity of these weights on the Bay floor. However, an estimated quantity can be established. If it is assumed that 50 tests have occurred per year over the last 50 years, and that each test dropped 26 lbs (11.8 kg) (2 weights at 13 lbs [5.9 kg] each), a total of 65,000 lbs (29,483 kg) of lead weight has accumulated on the bottom the DBRC. In addition, if one anchor is lost every five years, an additional 60,000 lbs (27,215 kg) of lead would have accumulated. This approximately 125,000 lbs (56,700 kg) of lead over a 50-year period, while not a significant effect, has added to the cumulative addition of heavy metal to the DBRC and the inland waters of Hood Canal in general. Most of this lead would be absorbed in bottom sediments and would not be mobile and available to the flora and fauna of the DBRC (see detailed analysis in Section 3.4.2.1).

A video inspection of two 1,000-yard (910 m) transect lines on the bottom of Dabob Bay perpendicular to the range centerline showed no evidence of any visible guidance wire, weights, anchors, or other debris, with the exception of one wooden piling or log and a portion of a frame-like structure (see Section 3.4.1.2).

Although a certain amount of copper guide wires and other hardware are released into the waters of Dabob Bay, they eventually become buried in the deep bottom sediments at water depths of between 120 and 600 feet (36 and 180 m). Waters at these depths tend to be cold, free from ultraviolet light, with sediments that are anaerobic below the upper few centimeters, slowing reactivity and decomposition and minimizing release of metals into the environment.

The guidance wire released is coated with polyethylene, a stable, insoluble and non-biodegradable plastic that prevents copper in the wire cores from being exposed to the water column and/or sediments. Only the wire ends are exposed, which release only very small amounts of copper into the environment, estimated to be a total of 0.005 gram per year for all released wire.

The vast amount of the lead, cadmium, aluminum, and iron in anchors, weights and other devices will remain unexposed to the water column and sediments inside the mass of the metal objects. Lead forms an insoluble sulfide layer upon contact with anaerobic bottom sediments, which prevents further leaching into the environment. Any lead which is leached from these objects would be absorbed onto sediment particles and would not be released into the pore water between the sediment grains. Other heavy metals also are absorbed onto anaerobic sediment particles, thus preventing or limiting exposure to marine organisms. Benthic infauna (invertebrates dwelling in the sediment in the upper few [1-2] cm of the sediments that are oxidized) and in the immediate vicinity (within a few cm) of the lost objects may show decreased abundance due to heavy metal lead exposure, however. This would be a highly localized effect and is not expected to be significant at a population level scale.

Surface sediment samples collected by the Battelle MSL on the bottom of Dabob Bay on the DBRC test range indicate that analyzed metals (Cd, Cu, Pb, Zn, Li, and Zr) are not present at elevated levels (Crecelius 2001). Metal concentrations observed are at low levels comparable to background levels present in other muddy, non-urban bays in Puget Sound. These concentrations are either well below Washington State sediment quality standards (Cd, Cu, Pb and Zn) or are at naturally occurring levels seen in sedimentary rock (Li and Zr).

In addition, sediments are estimated to accumulate for Dabob Bay at a rate of 0.027 to 0.044 inch per year (0.068 to 0.112 cm/year), and for northern Hood Canal at a rate of 0.082 to 0.378 inch per year (0.208 to 0.96 cm/year), eventually resulting in the burying of all materials within the anaerobic bottom sediments. Once buried below a few cm (the oxidized zone), they are not available to release toxic compounds into the water column. Although biological activity is typically present in the top 3.9 inches (10 cm) of sediments (WDOE 1991; Copping et al. 1989), objects deeper than that are accessible to only the deepest-burrowing organisms.

4.3 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

The Dabob Bay OMP does not propose new construction that would use natural resources or materials, nor does it proposed an increase or change in operational tempo that would use increased levels of resources or materials.

Thus, no irreversible or irretrievable commitment of resources is likely to occur with approval of the OMP.

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5.4 LIST OF AGENCIES AND PERSONS CONTACTED

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Kimberly Kler, Engineering Field Activity Northwest, Naval Facilities Command, telephone, October 19, 21, and 26, 1999, discussed logistics of tribal consultation letter.

Sara Steel, Cultural Resources Information Director, Washington State Office of Archaeology and Historic Preservation, September 16, 1999, meeting for records check.

6.0 LIST OF PREPARERS AND DISTRIBUTION LIST

6.1 LIST OF PREPARERS

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Port Gamble S'Klallam Tribe
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Lower Elwha Klallam Tribe
Suquamish Tribe.
Point No Point Treaty Council

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Defense Technical Information Center
Advisory Council on Historic Preservation
U.S. Fish and Wildlife Service
National Marine Fisheries Service
Naval Sea Systems Command (OOT)
Naval Undersea Warfare Command
U.S. Army Corps of Engineers

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Washington State Department of Ecology
Washington State Department of Fish and Wildlife
Washington State Department of Natural Resources

Local Agencies and Organizations

Kitsap County
Jefferson County
Kitsap and Jefferson County Libraries
Hood Canal Salmon Enhancement Group
Hood Canal Coordinating Council
University of Washington Shellfish Lab, Whitney Point

APPENDICES

Appendix A

Operations and Management Plan

DABOB BAY RANGE COMPLEX

Operations and Management Plan

April 18, 2001

Prepared for:

EFA Northwest
Naval Facilities Engineering Command

Prepared by:

MAKERS architecture and urban design

DABOB BAY RANGE COMPLEX
DRAFT OPERATIONS AND MANAGEMENT PLAN

4/18/2001

Table of Contents

List of Abbreviations

ADCAP	Advanced Capability
APEX	Acoustic Platform for Experiments
ASW	Anti-Submarine Warfare
BMA	Bottom-Moored Array
GPS	Global Positioning System
GTV	General Test Vehicles
K/B	Keyport/Bangor
NOAA	National Oceanic and Atmospheric Administration
NRS	Noise Recording System
NUWC	Naval Undersea Warfare Center
PRST	Post Refit Sea Trial
PSK	Phase Shift Keyed
ROP	Range Operating Procedure
ROV	Remotely Operated Vehicles
SCEPS	Stored Chemical Energy Propulsion System
SORD	Submerged Object Recovery Device
SS	Submersible Ship
SSN	Submersible Ship, Nuclear
SSBN	Submersible Ship Ballistic, Nuclear
SUBASE	Submarine Base
TDV	Torpedo Defense Vehicle
TRB	Torpedo Retrieval Boat
TROV	Tethered Remotely Operated Vehicle
UUV	Unmanned Underwater Vehicles
YP	Yard Patrol
YTT	Yard Torpedo Test

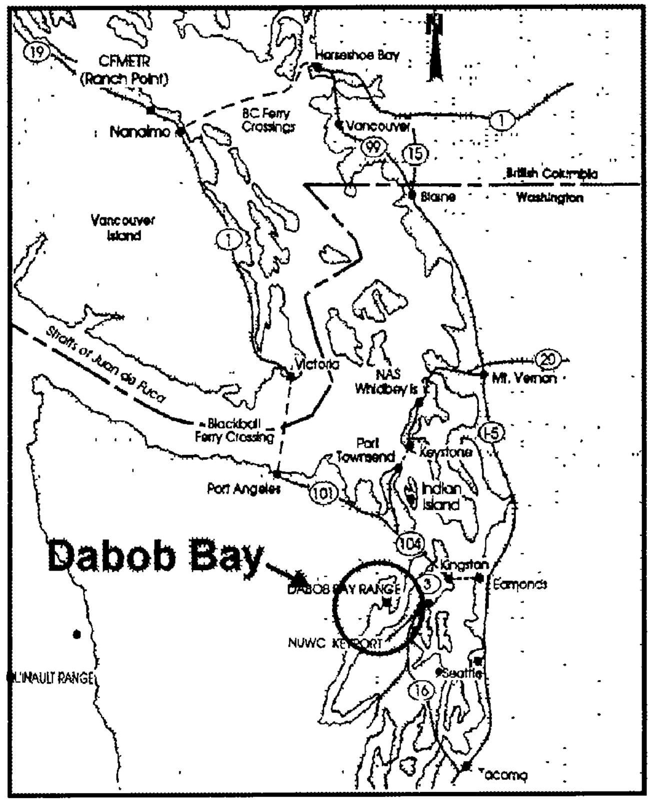

Figure 1: Dabob Bay Location

1. Introduction

a. Purpose

The purpose of the Operations and Management Plan is to describe the test activities within the geographic boundaries of the Dabob Bay Military Operating Area, the Hood Canal Military Operating Areas, and connecting waters *(hereafter referred collectively as the "Dabob Bay Range Complex")* in a descriptive, functional format. The plan focuses on the categories of test range activities, test range management, and resource management and coordinated measures. The overall action will ensure continued test range operations and maximize the existing and future potential Naval Undersea Warfare Center (NUWC) Division, Keyport, Washington use of resources in the Dabob Bay Range Complex.

Two separate documents are being prepared that will evaluate the impacts associated with the adoption and implementation of this Operations and Management Plan. An Environmental Assessment (EA) will address the environmental impacts pursuant to the requirements of the National Environmental Policy Act (NEPA) and subsequent implementing regulations issued by the Council on Environmental Quality (CEQ) (40 CFR Part 1500). A Biological Assessment (BA) will determine the potential effects on listed and proposed threatened or endangered species and their habitat. The Endangered Species Act (ESA) requires federal agencies to ensure that their actions do not jeopardize the continued existence of an endangered or threatened species or their critical habitats.

Based on the analysis in the EA, the Navy has determined that implementation of the OMP would not cause significant impacts to the environment: therefore, preparation of an Environmental Impact Statement is not necessary, and a Finding of No Significant Impact (FONSI) is recommended. The mitigation measures documented in the EA, BA and FONSI will be incorporated into the Final OMP.

b. Scope

The scope of the Operations and Maintenance Plan focuses on managing the operations at the Dabob Bay Range Complex with good stewardship of the range environment.

c. Format

The Operations and Management Plan is divided into five parts and an appendix. Part 1(Introduction) describes the purpose, scope, and format of the plan.
Part 2 provides an overview of the Dabob Bay Range Complex and its geographical and physical characteristics. Part 3 discusses the Navy's management program for the Dabob Bay Range Complex. Part 4 describes the characteristics of the tests that take place within the Dabob Bay Range Complex. Part 5 addresses environmental issues associated with general operations. The Appendix charts Dabob Bay Range Complex testing activities and associated environmental issues.

2. Operating Areas

The Operations and Maintenance Plan involves both the Dabob Bay and Hood Canal Military Operating Areas as well as their connecting waters. The Dabob Bay Range Complex is located in the Hood Canal 25 miles (40.23 km) west of Seattle *(see Figure 1)*. Dabob Bay's deep water and geographic nature provide ideal conditions for underwater weapons testing.

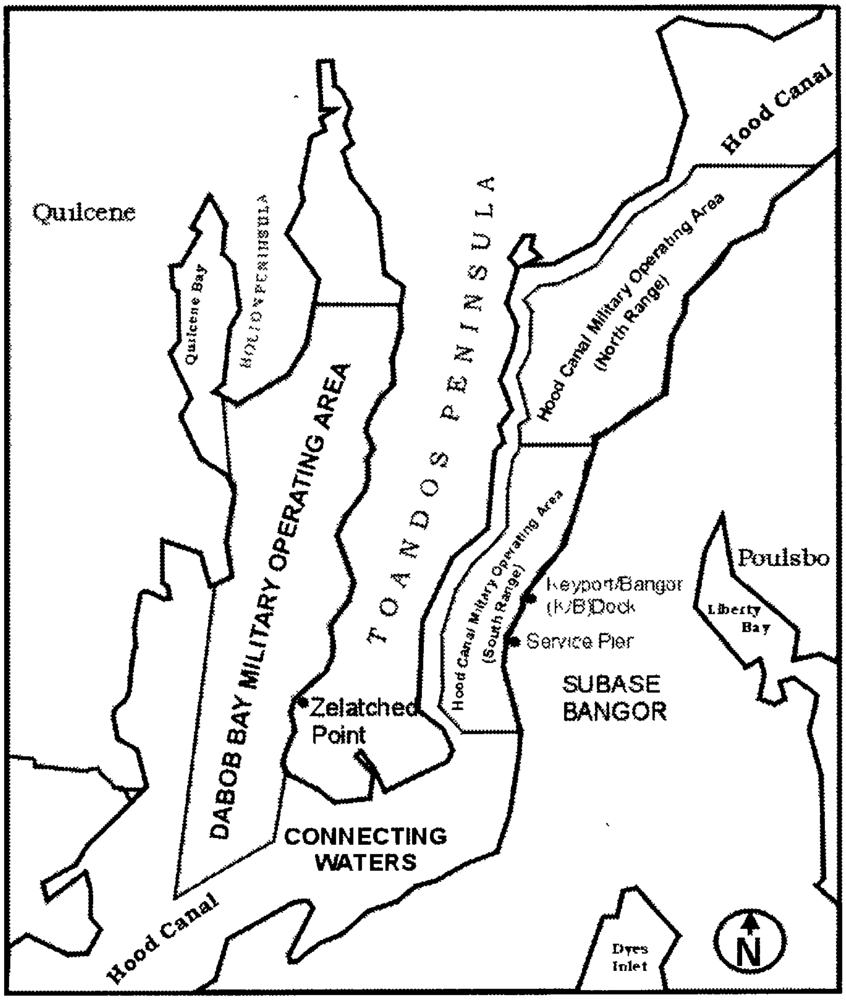

Figure 2: Operating Areas

a. Dabob Bay Military Operating Area

Keyport's first use of Dabob Bay for underwater testing occurred during the 1950s, when the site was instrumented with the capability for real time tracking. Dabob Bay provided the deeper water testing facilities that were required for torpedo testing after World War II. Installation of tracking gear in Dabob Bay made it the primary Keyport test facility. The tracking instrumentation on the bottom of this site is maintained for continual operation.

The tracking area within Dabob Bay is approximately 7.25 nautical miles (nm) (13.43 km) by 1.25 nm (2.32 km) and is shown in Figure 2. The long axis of the range coordinates is oriented 011^{o} T, and the center of the range site is located at 47^{o} 43' 34" North, 122^{o} 50' 28" West. The average depth of the site is 375 feet (114.25 m) with a maximum depth of 600 feet (182.8 m), and the bottom is mud and rock.

Range Facilities

Dabob Bay Range operations are staged from the Keyport/ Bangor dock at Subase Bangor. Site operations are controlled and recorded at the Range Control Center located at Zelatched Point on the Toandos Peninsula. The Range Control Center is the command post for the Range Officer and Weapons Test Director.

Seven permanently deployed short baseline arrays provide underwater tracking capability. They are spaced approximately 2000 yards (1,828 m) from center to center *(see Figure 3)*. Surface/airborne tracking is achieved by visual observation or Global Positioning System (GPS). Analog or digital tapes provide permanent recordings of tracking data. The raw range data is sent to Keyport for analysis and production of smooth data products.

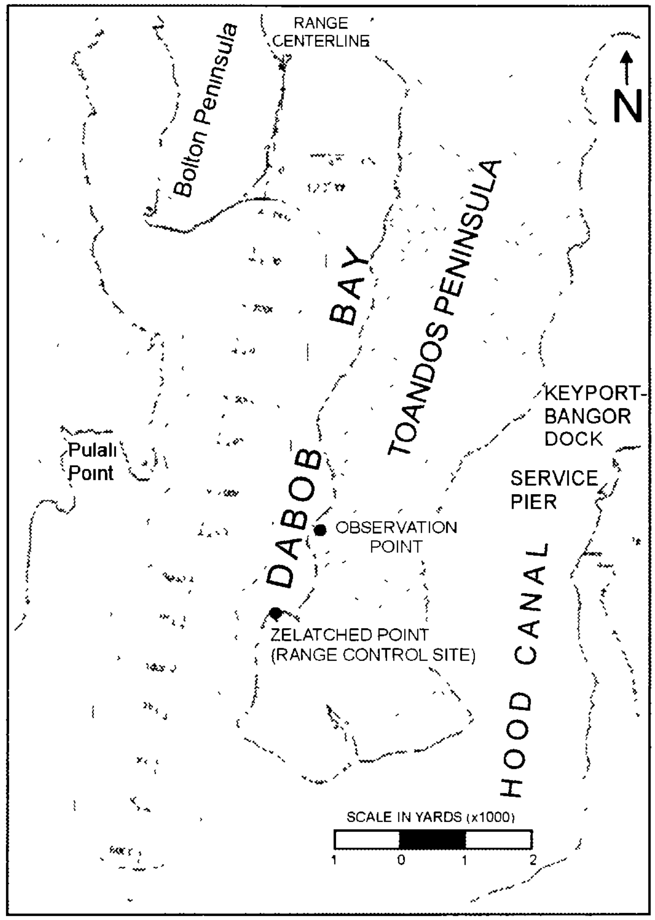

Figure 3: Dabob Bay

Tracking at Dabob Bay is accomplished using the Phase Shift Keyed (PSK) technique to simultaneously track separate targets with a relative accuracy of 10 feet (3.05 m). PSK involves a sound pulse that is uniquely coded.

There are other cables and systems located on the floor of Dabob Bay that are used to measure acoustic/magnetic signals or act as communications and submarine warning systems during operations.

The pier at Zelatched Point has been used historically for float planes and range craft berthing during operations *(see Figure 4)*. It is 300 feet (91.4 m) in length and can accommodate range craft. There is no power supply or pump-out capability at the Zelatched pier.

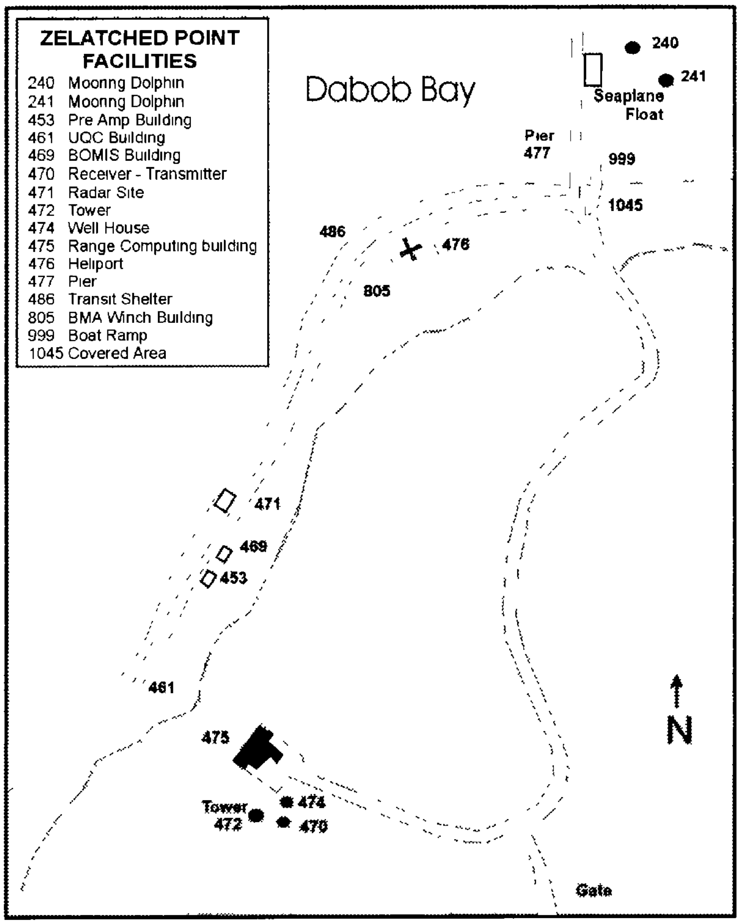

Figure 4: Zelatched Point Facilities

b. Hood Canal Military Operating Area

The Hood Canal Military Operating Area is located 5 miles west of Keyport, just west of Naval Submarine Base (SUBASE), Bangor. Range dimensions are approximately 4 nautical miles (nm) (7.41 km) by 1 nm (1.85 km) and the range center is located at 47° 46' 00" North, 122° 44' 00" West. The water depth averages 200 feet (60.93 m). The area is used to determine sensor accuracy, conduct special torpedo launches, and conduct simple tests not requiring underwater tracking.

Range Facilities

Support craft for the Dabob Bay Range Complex are deployed from the Keyport/Bangor (K/B) dock, located at SUBASE Bangor on the east shore of the Hood Canal. Five surveyed transit sites, one on the west side and four on the east side of the canal, are available for visual tracking. Two radar reflectors and other portable equipment are used to test radar range and bearing accuracy. No noise monitoring equipment or communications gear is permanently installed.

c. Connecting Waters

The waters linking the Hood Canal and Dabob Bay Military Operating Areas are referred to as the "Connecting Waters." These waters are currently used to transit boats to the Dabob Bay Military Operating Area from the Keyport/Bangor (K/B) dock within the Hood Canal Military Operating Area. In the future, the connecting waters may be used to transit underwater vehicles.

3. NUWC's Management Program

a. Project Management on the Range.

Every project that is proposed for test on the range will have a complete environmental review before conducting any on-range testing. Items that will be reviewed include:

Examine for inclusion under existing range NEPA documentation,
Examine existing NEPA documentation available for the project,
Examine for potential impacts to NUWC environmental stewardship goals

b. Range Operations Management

The Dabob Bay Range Complex is operated using NUWC Division, Keyport procedures and governing regulations. Environmental compliance procedures are covered by OPNAVINST 5090.1B and NUWCINST 5090.1B. Many of the general procedures and descriptions are included in the Range Operating Procedure (ROP), NUWC Report 1509. This document provides policies and procedures for the planning, scheduling, and execution of tests and operations on NUWC Division, Keyport ranges. The need for frequent updates has been recognized to increase the document's usefulness as the nature of weapons testing and support undergoes change. The ROP is organized by the following activities:

- Scheduling
- Personnel
- Transportation
- Range Craft
- Operations
- Communication
- Recovery
- Weapons/Target/Other Underwater Vehicles
- Safety
- Reports
- Security
- Miscellaneous

For each type of operation within these categories of activities, the ROP provides objectives, policies, responsibilities, procedures (including attached applicable forms), and approval.

Individual weapon testing events are governed by "Run Plans." A run plan provides range personnel with the technical requirements of a range test as well as specifying the range resources required to meet the test objectives. A run plan will also contain information regarding special requirements (special range and recovery equipment) required to support operations. Run Plans include provisions for dealing with marine mammal sightings and other related environmental issues.

c. Range Monitoring

Range personnel will monitor and log the listed items whenever the range is in use. This data will be archived and maintained for at least a 10-year period for use in future studies related to the sustainability and management of the range. It shall be the responsibility of the range operators, including the range officer, to insure that this data is accurate.

Number of boats contacted to:

Clear the range,

Come to full stop.

Number of boats that were unable to be contacted, thus ranging was held up during their transit.

Adverse interactions with citizens.

Damage to fishing hardware/boats incurred during ranging (list of circumstances and owners if known).

List of hardware not retrieved/recovered in the DBRC for each test:

Anchors,

Lead Weights,

Copper Wire,

Torpedo Hardware (with description),

Other hardware (with description).

Marine mammal sightings, by species.

d. Outreach

As part of the long-term relationships that are to be sustained as part of the stewardship, range activity schedules will be provided to the American Indian Tribes and the Point No Point Treaty Council. It will be the responsibility of the range scheduler(s) to insure that the data is provided weekly in a format that is easily understood by the recipients. In exchange the Point No Point Treaty Council will provide NUWC Division Keyport with their fishing season schedule information and related emergent information.

4. Test Characteristics

a. Categories of Operation

The majority of operations conducted within the Dabob Bay Range Complex can be divided into four categories; research and experimental, proofing, fleet operations, and other. *(See Figure 5.)* Most operations are research and experimental tests (65 percent). Proofing and fleet operation tests each comprise 15 percent of total testing operations, while other testing are the remaining 5 percent of the operations. Most of these operations require support operations prior to, during, and upon completion of the test. Support operations include measuring the test conditions such as temperature, salinity, conductivity, and acoustic/ambient water conditions prior to testing and the retrieval/recovery of the test unit upon completion.

The Operations and Management Plan, however, is not intended to preclude the changing of processes or characteristics of current operations to ones that are more environmentally friendly, as they are identified.

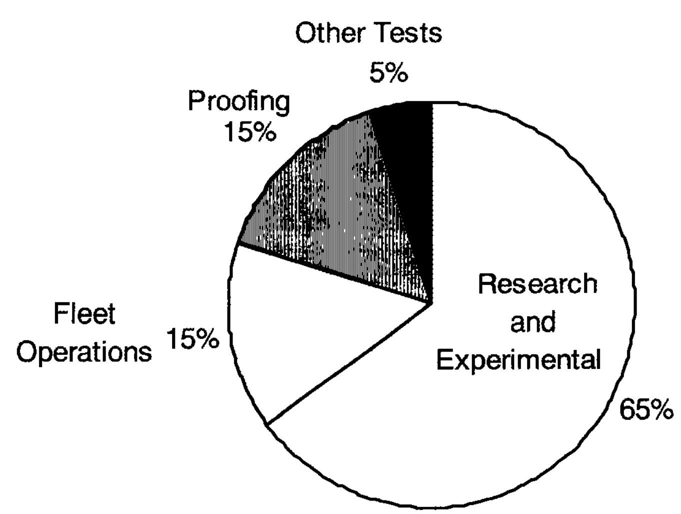

Figure 5: Categories of Operation at the Dabob Bay Range Complex

(1) Research and Experimental

The majority of operations at the Dabob Bay Range Complex are conducted to test the operational capabilities of experimental test units. Primary systems involved with experimental tests include torpedoes, targets, unmanned underwater vehicles (UUV), and stationary measurement platforms.

Various parameters are monitored as test units are subjected to a battery of tests, designed to provide data on acoustic and dynamic performance. Testing of acoustic performance may include the evaluation of self noise (internally recorded), data gathering capabilities, nature and intensity of electromagnetic disturbances, target identification, classification, acquisition and homing systems, signal processing, effects of deployed counter measures, terminal placement tactics, and the unit's acoustic signature (radiated noise). Dynamic performance testing determines dynamic control and propulsion capability by measuring the unit's ability to deploy, turn, dive, climb, accelerate, decelerate and control maneuvering parameters (heading, depth, speed, roll, and turn rate) under various environmental conditions.

(2) Proofing

Production acceptance testing involves in-water (proofing) tests that ensure the torpedo meets all service performance standards including quality, reliability, maintainability, and supportability.

Proofing tests allow the customer and supplier to conclude the torpedo procurement process with a performance demonstration of the final product in water. Test procedures follow the same stringent guidelines as found in quality assurance test programs on the shop floor, in environmental stress screening and periodic tests, and in factory acceptance test and inspection programs. Operations are designed to provide an orderly progression of testing in planned phases.

(3) Fleet Operations

The Dabob Bay Range Complex supports evaluation programs and equipment tests for the U. S. Navy. Evaluation programs are utilized to assess the combat readiness of a vessel, system, and/or personnel.

Tests in this category conducted at the Dabob Bay Range Complex include the Trident Post Refit Sea Trial (PRST), other submarine testing, antisubmarine aircraft, and surface ship testing. This testing is accomplished to certify that the vessels are ready for their operational missions.

(4) Other Tests

Range work and other non-repetitive testing make up the remaining 5 percent of testing efforts within the Dabob Bay Range Complex. Some of this testing is accomplished in support of the National Oceanic and Atmospheric Administration (NOAA), private, and other organizations.

b. Activities

(1) Systems Testing

(a) Launching Systems

Weapon systems at the Dabob Bay Range Complex can be launched from range support vessels, fleet vessels, and aircraft. Range support vessel and fleet vessel launches employ pressurized air-over-water, compressed air, or simple release devices to deploy test units. Air launches, which account for only a small percentage of all launchings at the Dabob Bay Range Complex, deliver torpedoes over the desired coordinates. Air launched torpedoes employ a parachute for deceleration. The parachutes are released at water entry.

Most torpedoes are launched from the Yard Torpedo Test (YTT) firing craft (approximately 65 percent of all launches). The YTT can launch vehicles using underwater torpedo tubes, deck mounted lightweight torpedo tubes, or specialized deck mounted launchers. Two YTTs currently support range operations at the Dabob Bay Range Complex. Other range support vessels used for launching services include special purpose barges (which account for approximately 25 percent of all launches) and Torpedo Retriever Boats.

Fleet vessel launches can include Cruisers, Destroyers and Frigates, Fleet Ballistic Missile Submarines, and Attack Submarines. These may account for an estimated 20 launches per year at the Dabob Bay Range Complex. Air launches involve Helicopters, such as the SH-60 and fixed wing aircraft, including the P-3C Orion. Air launches may account for approximately 10 launches per year.

In order to test launcher systems, it is necessary to make launches using a non-running representation of the vehicle. These vehicles may or may not be positively buoyant at launch. In some cases, in order to achieve positive buoyancy, water and air are expelled from the vehicle.

(b) Thermal Propulsion Systems

Thermal weapon systems utilized at the Dabob Bay Range Complex include those associated with Otto Fuel II powered systems and the Stored Chemical Energy Propulsion System (SCEPS). In the future, additional experimental thermal systems may be tested at the Dabob Bay Range Complex.

<u>Otto Fuel II:</u> Otto Fuel II-powered systems include variations of the MK 46, MK 48, and MK 54 torpedoes. They are designed to attack submarines. Their propulsion systems are based on an external combustion engine that employs a monopropellant, Otto Fuel II. Heat is transferred from the engine to the cooling water, which is then mixed with exhaust gases from the engine cylinders via the hollow propeller drive shaft.

Table 1 indicates all of the releases from the testing of Otto Fuel-powered systems. These relatively small amounts of chemicals dissipate quickly during torpedo tests.

Activity	Material Released
Otto Fuel II Byproducts	Propellant Grain Combustion Byproducts (H_2, CO_2, CO, H_2O, N_2, HCl, CH_4)
	Otto Fuel II and Combustion Byproducts (CO, H_2O, CH_4, CO_2, N_2, NO_2, H_2, C_xH_x, HCN)

Table 1. Releases Associated With Otto Fuel II Powered Propulsion

Stored Chemical Energy Propulsion System (SCEPS): SCEPS is a closed cycle, Rankine steam system. The major components of the system are the boiler (with steam generating tubes), turbine, condenser, and condensate pump. The boiler consists of an internal chamber where sulfur hexafluoride (SF_6) is sprayed into molten lithium, causing an exothermic reaction. The internal chamber is encased in steam generating tubes filled with heat absorbing water. Sufficient heat is absorbed to change the state of the water from liquid to steam. The high pressure steam is used to rotate a small turbine, connected via reduction gears to the drive shaft.

Only heat escapes into the environment. Both the reactants and products of the reaction of SF_6 and lithium are contained within the internal reaction chamber of the boiler. The condensation and steam are sealed within their own separate system and do not contact the reactants or products of the reaction. Heat is transferred from the steam to the cool sea water passing over the torpedo via the condenser incorporated into the torpedo outer shell.

(c) Special and Exotic Propulsion Systems

Testing at the DBRC can include the testing of specialized research vehicles that have exotic propulsion systems. One of the exotic propulsion systems utilized at DBRC is a Rocket Motor. Exotic propulsion systems are used on forms of Unmanned Underwater Vehicles.

Estimated 12 test runs, including stationary tests, may be conducted annually at DBRC. A single test run can be up to 14,000 yards (12,796 meters) long.

For the tests using the rocket motor the exhaust components released in gaseous form during a run include carbon monoxide, carbon dioxide, ethane, methane, hydrogen chloride, hydrogen, and nitrogen. The exhaust components present in either liquid and/or gaseous form include water, hydrogen cyanide and ammonia. The exhaust components present in solid (or dissolved particulate) form include carbon, iron chloride and zirconium oxide. These exhaust components will be diluted over the test run to very low levels.

No information is known for other exotic propulsion systems and environmental reviews will have to be accomplished for any of these systems as they are defined and planning is begun for each system.

(d) Electric Systems

Electric vehicles utilized at the DBRC include General Test Vehicles (GTV), Unmanned Underwater Vehicles (UUV), and MK 30 Targets. These systems have historically been powered using sealed silver-zinc batteries.

General Test Vehicles are a form of unmanned underwater vehicles. GTVs are used as the propulsion testbed for various sonar/torpedo projects at the Dabob Bay Range Complex.

UUVs can undertake a number of testing missions including submarine warfare, anti-submarine warfare, ocean surveillance, mine warfare, special warfare, and non-combat operations and special projects.

MK 30 Targets are mobile targets used in fleet training. They also uses silver zinc batteries and an electric motor for propulsion.

(e) Other Testing Activities

Other testing activities at the Dabob Bay Range Complex include submarine testing, mine sweeping, trawler exercises, acoustic and magnetic array testing, countermeasures, sonar testing, impact testing, and static testing in water.

Submarine Testing: Submarine testing can involve radiated noise measurement tests and general operation characteristics. Approximately 45 test runs per year are projected.

Mine Sweeping: Testing operations involve the use of support craft in the sweeping of mine fields. Approximately 20 test runs per year are projected.

Non-Navy Testing Such As Trawler Exercises: Instrumentation for tracking above and below water systems for non-military use such as NOAA. Support craft are utilized in the exercises. Approximately five test runs per year are projected.

Acoustic and Magnetic Array Testing: Experimental array temporarily installed on the sea bottom for measurement of signals. Approximately ten test installations per year are projected. Some tests have included the use of explosive charges as acoustic sources.

Countermeasures: Countermeasures are devices that distract a sonar including a torpedo from its target. One example is for countermeasure devices to act as a decoy to create sufficient noise to mask any sonar returns from the target. Approximately 50 countermeasure tests per year are projected.

Sonar Testing: New and modified sonars are sometimes tested against real or artificial targets. Ships, submarines, aircraft or other small craft can deploy these. Approximately 10 test days per year are projected.

Impact Testing: During normal testing of torpedoes, test units are programmed not to hit the target. They may be programmed to turn away from the target at a predetermined point prior to impact. In some cases a depth cut off or ceiling cut off are part of the program such that the weapon may pass below or above the target and commence a re-attack without turning away. In rare instances torpedoes are actually programmed to impact the target to verify proper operation.

Approximately 10 impact tests per year are projected.

Static Testing in Water: The Acoustic Platform for Experiments (APEX) test involves static testing. This platform is located in Dabob Bay and has historically been used for research and development of instrumented underwater vehicles. It is available for use but is seldom used. The platform holds the test vehicle underwater in a stationary position while the propulsion system is operated using load disks rather than propellers. For Otto Fuel II propulsion systems, this creates a unique situation where gases are exhausted in a small area.

Approximately 10 tests per year are projected.

(2) System Retrieval and Recovery

Most weapons tested at the Dabob Bay Range Complex contain buoyancy systems that allow test units to float to the surface of the water. Surface craft or helicopters perform retrieval operations. Approximately 5 percent of weapons systems tested at the Dabob Bay Range Complex require deep-water bottom recovery (negatively buoyant test units). Although some bottom recovery efforts are the result of a test unit malfunction, more frequently, a test unit deliberately sinks to the sea floor to simulate a real world tactical situation. These test units are typically found at or near the surface of the sea bed and require little or no excavation effort. A smaller percentage of test units can be buried under the surface of the seabed to depths up to 30 feet. Buried units require recovery efforts from the Submerged Object Recovery Device (SORD).

(a) Buoyant Systems

Test units retrieved at the water's surface at the Dabob Bay Range Complex employ one of two types of buoyancy systems: Positive buoyancy or active buoyancy. Positively buoyant systems include the MK 46 and MK 48 torpedoes, which can be buoyant at launch. Approximately 55 percent of all test units launched are positively buoyant. Active buoyancy systems utilize an end-of-run bag, which is inflated using a gas such as nitrogen or carbon dioxide to float the test unit or deploy weights at the end of run. Approximately 40 percent of all test units launched contain active buoyancy systems. *(See Figure 6.)* MK 46 torpedo tests involve the release of lead ballast at the end of the run to make them positively buoyant.

Surface Craft Retrieval Operations: In general, surface retrieval of test units is conducted by one of two methods. In the first method, a TRB is maneuvered along side a test unit and a swimmer enters the water and places a cage over the unit's nose. A line is then attached to the nose cage and led back to the retriever boat transom, where crew members guide the test unit to the boat and replace the retrieval line with a winch line.

The second retrieval method requires a boat to be maneuvered along-side the floating unit in order to position a rubber snare loop around the body. The loop is located on the end of a long aluminum pole with a T-handle. The test unit is then slowly led around to the boat transom where another crewmember installs a nose cage, if necessary and winch line.

Helicopter Retrieval Operations: Lightweight torpedoes, heavyweight torpedoes, and mobile targets can be retrieved by helicopter. Two types of helicopters are employed. A small Hughes 500D (or equivalent) is used in the retrieval of lightweight MK 46, MK 50, and MK 54 torpedoes. Heavyweight torpedoes and mobile targets are retrieved using a large Sikorsky model S61L (or equivalent). Due to their cost, large helicopters are typically used only during special operations involving fleet units during winter months. Helicopter retrieval devices are either nets or specially shaped cages.

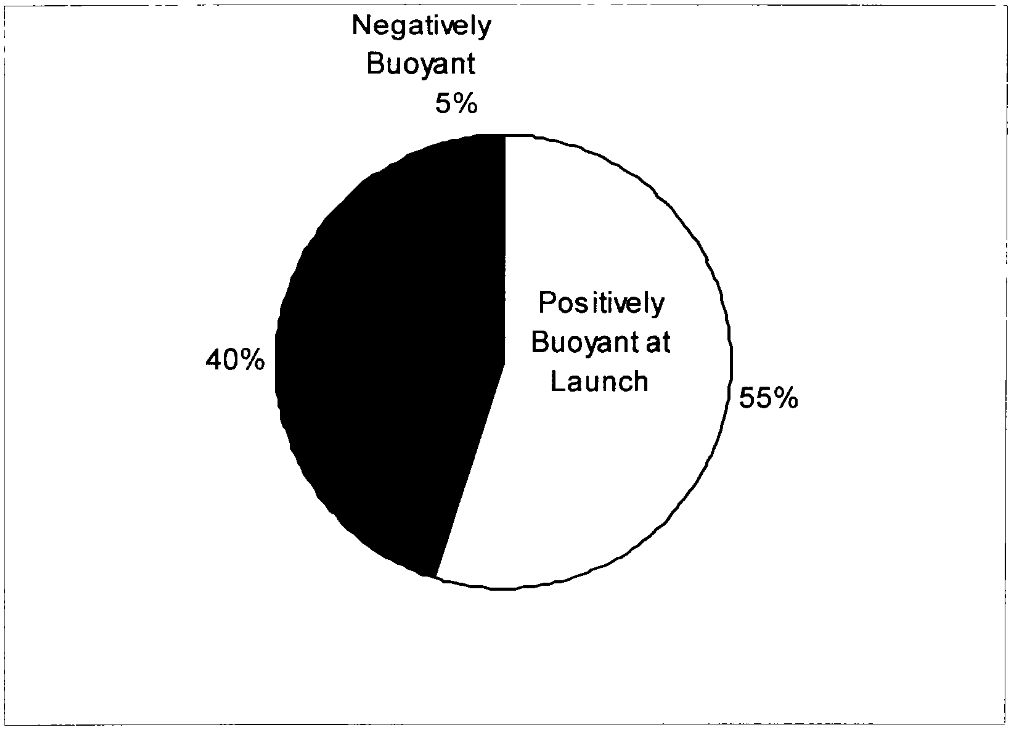

Figure 6: Buoyancy systems of tested weapons.

(b) Negatively Buoyant Systems

Buried Units: Buried test units are recovered using the Submerged Object Recovery Device (SORD), which is anchored to the sea bottom and utilizes a suction system. The components of the SORD system consist of the vehicle, control consoles, hydraulic power pack, umbilical winch system, and three kedging winches. To deploy the vehicle, the firing/ recovery craft must be in a three point moor requiring three buoys. SORD is maneuvered with 3 kedge wires. SORD is capable of recovering units up to a depth of 30 feet in the sediment.

Unburied Units: Most of the test units are found laying on top of the bottom sediment and can be recovered with only minimal disruption of the seabed. These bottom recoveries involve the use of cable controlled, free swimming Remotely Operated Vehicles (ROVs).

(3) Range Support Activities

Range support activities have been divided up into two categories: Fleet operations and Keyport operations.

(a) Fleet Operations

Surface Ship Operations: Fleet vessels used at the Dabob Bay Range Complex include: Frigates, cruisers and destroyers. Approximately 10 fleet surface ships are projected to utilize the area per year.

Aircraft Operations: Fleet aircraft used at the Dabob Bay Range Complex include: SH-60 and P-3. Approximately 30 aircraft operations are projected in the area per year. General flight rules within Dabob Bay Range Complex require aircraft to be at least 500 feet above the level of the sea and 1,000 feet above the level of the land and areas of water within 500 feet of the shoreline. Exceptions involve weapons retrieval or launching and the landing/takeoff of rotary wing aircraft at the Zelatched Point helipad within landing/takeoff constraints. General flight rules require an over water approach and departure from/to the Zelatched Point helipad.

Submarine Operations: Fleet submarines used at the Dabob Bay Range Complex include: SSN, SSBN, and SS (Diesel-electric). Submarines are projected to utilize the area approximately 30 times per year.

(b) Keyport Operations

Support Craft Operation: Keyport currently maintains support craft ranging in size from the 186 foot Yard Torpedo Test (YTT) vessel to the 13 foot special projects boat. Activities can include target and acoustic services, recovery services, cable laying and range maintenance services, weapon firing and retrieval, diver tending, range security, and community emergencies/relations. Support craft used at the Dabob Bay Range Complex include: Yard Torpedo Tender (YTT), Torpedo Retrieval Boat (TRB), Yard Patrol (YP), Motorized Barge, and miscellaneous other support craft.

Buoy use: Buoys are used for vessel moorage when the vessel must remain stationary during testing operations. The moorings are also used during recovery and other operations when an exact position must be maintained. The buoy anchors are 6000-lb diamond-shaped lead anchors with a 1.6-inch diameter nylon mooring line connecting the anchor with a surface mooring buoy. The shape of the anchors allows deep penetration into the soft sediment, ensuring that the vessel is adequately secured to the range site bottom. They are generally planted and retrieved by the YTTs.

One semi-permanent buoy is placed near the Zelatched Pier. All other buoys are installed as needed for mooring during testing operations.

Operation of Shore Facilities: This includes general shore activities such as limited loading and storage activities and the operation of office and computer facilities. Shore facility operations occur on a daily basis throughout the year.

Operation of Acoustic Acquisition Equipment: Acoustic measurements at the Dabob Bay Range Complex include the measurement and recording of ambient noise, radiated noise, and sonar noise. Hydrophone systems are used to acquire acoustic data from key events such as torpedo starts, runs, shutdowns, and squib initiations. The information is returned to Keyport for analysis. Specific equipment includes the Noise Recording System (NRS) and the Bottom-Moored Array (BMA). The NRS is deployed for approximately 50 percent of all test runs. The BMA is permanently bottom-deployed.

Operation of Range Tracking Equipment: Tracking at the Dabob Bay Range Complex is performed using underwater sonar (75 kHz pingers) and above water GPS. Range tracking equipment is utilized for weapons testing events.

Operation of Targets: Both stationary and mobile targets are used to support the evaluation of a weapon system's Anti-Submarine Warfare (ASW) capabilities. Stationary targets are suspended off of range craft including barges. The MK 30 Target is one example of a mobile target. Stationary targets are utilized in approximately 70 percent of testing events, while mobile targets are utilized in only 10 percent of testing events.

5. Environmental Issues

a. Water Quality Issues

Water quality issues associated with Dabob Bay Range Complex's operations include exhausted materials from weapons testing events, bottom recovery activities and range support activities. Pollutants in the marine environment are widely distributed by currents. During normal testing events, such pollutants quickly dissipate in water.

b. Biological Quality Issues

The biological environment includes many different species of marine fish, sea birds, and marine mammals, as well as inhabitants of the pelagic environment such as phytoplankton. Factors that impact air and particularly water quality will also affect the biological environment. The Dabob Bay Range Complex, once remote, is witnessing increased fisheries and pleasure boating activities. Increased activities from areas outside or around the range complex may have caused additional wildlife populations to seek refuge/habitat/food within Dabob Bay. Range operations currently include wildlife monitoring and reporting to agencies such as the National Marine Fisheries Service.

c. Noise/Acoustics Issues

Many range operations generate noise. All underwater weapon systems utilize PSK acoustic transducers (pingers) that emit noises to allow for tracking: 75 kHz pinger with downward focused noise. These pulses are received by hydrophones on arrays and transmitted through submerged cables to the computer site. The computer uses time of signal receipt at the underwater hydrophones to calculate the position coordinates of the object. Systems under test may also transmit forward oriented noise in the 5-100 kHz bands.

d. Sociological Issues

During testing, watercraft are prohibited from transiting the range site, which extends the entire length of Dabob Bay, just prior to, and during torpedo in-water tests. Airspace is not restricted. These restrictions are for security and safety reasons, and to limit the amount of radiated noise into the water. The frequency of testing increases during the summer months due to favorable operating conditions and decreases during the winter months. Representatives of NUWC Division Keyport notify representatives of the affected tribes to coordinate testing activity and tribal fishing plans to avoid disruption to tribal fishing patterns.

e. Catastrophic Events

A catastrophic event represents the greatest potential for environmental harm during testing operations at Dabob Bay Range Complex. Examples of possible catastrophic events would be the rupture of fuel storage tanks of surface ship or support craft, the rupture of a torpedo, an event associated with the possibility of an errant torpedo, or the loss of the hydraulic fluid contained within the underwater recovery vehicle.

(1) Underwater Recovery Operations

Generally a catastrophic event involving an underwater recovery vehicle would result in the loss of the hydraulic fluid contained within the vehicle. The largest amount of hydraulic fluid that could be lost is 5 gallons of Mobil DTE-32 contained in SORD IV. If the tether were severed, a recovery operation would be initiated to recover the unit. Any type of fitting or hose malfunction would cause a spill and the oil may not be apparent on the surface. Maintenance records can point out a slow leak such that the vehicle can be fixed.

(2) Surface Ship Operations

A catastrophic event represents the greatest potential for environmental harm during vessel operations or transit to or from the range site. An example of such an event would be the rupture of fuel storage tanks, resulting in a release of fuel oil to the water. The YTTs have a fuel storage capacity of 34,182 gallons, any tank rupture would be considered a major spill. Due to the use of separate, self contained fuel tanks and the availability of immediate response teams the likelihood for a release of all fuel is unlikely.

(3) Response

Keyport is prepared to respond to mitigate the effects of a catastrophic event. An oil and hazardous substance release contingency/response plan has been disseminated, which establishes a trained spill response team, assigns responsibilities during an incident, and provides for proper notification to outside governing agencies such as the U.S. Coast Guard and Naval Sea Systems Command. Keyport maintains spill response equipment, including spill response vessels and containment booms, for immediate use.

Appendix: Test Activities and Characteristics

The chart on the following pages describes the operational activities that occur within the Dabob Bay Range Complex. For each individual activity, the chart provides a brief description and highlights the projected range usage and associated environmental issues. Projections in the "Estimated Amount " column are generally based on figures for the approximate number of events per year within the Dabob Bay Range Complex. The chart describes environmental issues, including air quality, water quality, biological quality, and acoustic/noise issues, as they relate to or affect the operational characteristics of testing activities at the Dabob Bay Range Complex.

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ACTIVITY AND PLATFORM/ SYSTEM USED	ESIMATED AMOUNT	AIR QUALITY ISSUES	WATER QUALITY ISSUES	BIOLOGICAL ISSUES	ACOUSTICS/NOISE ISSUES
I. Systems Testing:					
A. LAUNCHING SYSTEMS					
1) **Range support vessels.** Nearly all range support vessel launches are from the Yard Torpedo Test Vessel (YTT) or barges The YTT can launch vehicles using underwater torpedo tubes, deck mounted lightweight torpedo tubes, or specialized deck mounted launchers Two YTTs currently support range operations Four special purpose barges are available to act as a firing/ launching platform Launches from Torpedo Retriever Boats may occur at the Dabob Bay Range Complex Pressurized air-over-water, air pressure, or simple release devices are used to deploy the test unit In order to test launcher systems, it is necessary to make launches using a non-running representation of the vehicle These vehicles may or may not be positively buoyant at launch To achieve positive buoyancy, water and air may be expelled	90-95% of launches occur from range support vessels (no more than 255 per year) Of those, approximately 70% are launched from YTTs (approximately 180 per year) while 30% are launched from barges (approximately75 per year) approximately50 launches per year	No pollutants are released into the air since the applicable launch systems use water or compressed air as the motive force for launching The various firing craft containing the launching systems, however, utilize diesel or gas powered propulsion Exhaust from diesel and gas outboard engines is the primary air pollutant associated with their operation (see 3 B(1)) For units with a buoyancy bag, after recovery the gases inside the bag are vented into the air	Range support and fleet vessel launch systems use air and water pressure to eject the torpedo without releasing any debris into the aquatic environment Units without buoyancy bags expel water and air into the surrounding water	Ongoing development and population increases in the Puget Sound and, more specifically, in the vicinity of the Dabob Bay Range Complex, may cause wildlife populations to seek refuge/habitat/food in Dabob Bay due to its undeveloped state Vessels operating within the Dabob Bay Range Complex comply with the Marine Mammal Protection Act, which protects marine mammals from being harassed, hunted, captured, or killed Prior to commencing in-water torpedo runs, it is Keyport policy to establish an exclusion zone and complete a survey to ensure that there are no marine mammals within this zone Range operations also include wildlife monitoring and reporting to agencies such as the National Marine Fisheries Service (NMFS)	During testing, public access to the range site is restricted to limit the amount of radiated noise into the water Vessels on the range may be asked to stop their engines during the test to ensure valid acoustic recording Many range operations, including systems launching, generate noise Standard procedure at the Dabob Bay Range Complex is to suspend testing activities if mammals are located within the downward or forward cones of noise from a system's sonars The Noise Control Act provides federal performance standards which are designed into new ship systems and equipment to reduce noise emissions However, military aircraft, combat equipment, and weapon systems are exempt from the new product standards and retrofit modifications are not required Workplace noise is not considered environmental noise
2) **Fleet Vessels.** Cruisers, Destroyers and Frigates, Fleet Ballistic Missile Submarines, and Attack Submarines can be used to launch torpedoes at the Dabob Bay Range Complex Pressurized air-over-water or compressed air are used to deploy the test unit	A small percentage of torpedoes launched at the Dabob Bay Range Complex are from fleet vessels Approximately20 launches per year may occur	Same as above Exhaust from diesel and gas turbine engines are the primary air pollutant associated with their operation	Same as above	Same as above	Same as above
3) **Aircraft.** Helicopters, including the SH-60 and fixed wing aircraft, including the P-3C Orion, can be used for lightweight torpedo launching exercises within the Dabob Bay Range Complex Air launches involve dropping a torpedo over desired coordinates A parachute is opened to decelerate the torpedo and is released at water entry	Approximately10 air launches may be conducted per year	Same as above	The parapack (nylon/metal), suspension bands (steel) and frangible nose cap (plastic) are referred to as air accessories, are not retrieved, contribute to bottom debris The equipment typically sinks and is not expected to wash up on shore but it could contribute to shoreline garbage	Same as above	Same as above General flight rules within the Dabob Bay Range Complex require an over water approach/departure from/to the Zelatched Point helipad Except for departures/landings from/to the helipad, aircraft must be at least 500 feet above the level of the sea and 1,000 feet above the level of the land and areas of water within 500 feet of the shoreline

ACTIVITY AND PLATFORM/ SYSTEM USED	ESIMATED AMOUNT	AIR QUALITY ISSUES	WATER QUALITY ISSUES	BIOLOGICAL ISSUES	ACOUSTICS/NOISE ISSUES
B. THERMAL PROPULSION SYSTEMS					
1) Otto Fuel II Powered Systems All Otto Fuel II powered systems used at the Dabob Bay Range Complex are variations of the MK 46 or MK 48 torpedo The MK 48 torpedoes are designed to attack deep-diving nuclear submarines Their propulsions systems are based on an external combustion engine Otto Fuel II, which is a monopropellant, is injected into the combustion chamber The hot, high pressure combustion gases are directed into the cylinders sequentially Cooling water is extracted from the surrounding sea and pumped through passages in the propulsion system Heat is transferred from the engine to the cooling water, which is then mixed with exhaust gases from the engine cylinders and discharged into the environment via the hollow propeller drive shaft	Approximately 90 test runs per year are projected	The external combustion engines produce reaction byproducts that are exhausted into the water The exhaust materials disassociate quickly in water These byproducts may include Carbon Monoxide, Water, Methane, Carbon Dioxide, Nitrogen, Nitrous Oxide, and Hydrogen, as well as Hydrogen Cyanide, Hydrochloric Acid, and various Hydrocarbons The various firing craft containing the weapon systems utilize diesel powered propulsion Exhaust from diesel and gas turbine engines is the primary air pollutant associated with their operation (see 3 B(1))	The emissions from these systems include cooling water and exhaust gases These relatively small amounts of chemicals released along the torpedo course and dissipate quickly during normal torpedo tests Refer to Table 1, for Releases Associated With Otto Fuel II Powered Propulsion System	Ongoing development and population increases in the Puget Sound and, more specifically, in the vicinity of the Dabob Bay Range Complex, may cause wildlife populations to seek refuge/habitat/food in Dabob Bay due to its undeveloped state Vessels operating within the Dabob Bay Range Complex comply with the Marine Mammal Protection Act, which protects marine mammals from being harassed, hunted, captured, or killed Prior to commencing in-water torpedo runs, it is Keyport policy to establish an exclusion zone and complete a survey to ensure that there are no marine mammals within this zone Range operations also include wildlife monitoring and reporting to agencies such as the NMFS	During testing, public access to the range site is restricted to limit the amount of radiated noise into the water Vessels on the range may be asked to stop their engines during the test to ensure appropriate tracking of torpedoes Many range operations, including those involving thermal powered systems, generate noise All torpedoes utilize a 75 kHz pinger with downward focused noise to allow for tracking and a 5 to 80 kHz forward focused sonar used to "home in" on targets Standard procedures at the Dabob Bay Range Complex require suspending testing activities if mammals are located along the course of the torpedo The Noise Control Act provides federal performance standards which are designed into new ship systems and equipment to reduce noise emission However, military aircraft, combat equipment, and weapon systems are exempt from the new product standards and retrofit modifications are not required Workplace noise is not considered environmental noise
Guidance Wire The MK 48 torpedoes can operate with or without Guidance Wire The guidance wire from the MK 48 torpedoes is slightly negatively buoyant and consists of plastic-coated copper which connect the torpedo to the launch platform and allow guided control after launch At the end of the test run, the wire is cut away from the torpedo and the launch platform, allowing it to sink to the bottom of the range site A MK 48 torpedo can carry up to 20,000 yards of guide wire When it is deployed it may release up to 114 pounds of guidance wire during a single test When it is used, the average amount of guide wire released is 15,000 yards or 85 pounds An alternative to the copper wire is used by some UUVs and on an experimental basis by other vehicles This is a fiber optic cable, the same diameter as the current copper wire The fiber optic is usually the same length as the current copper wire	All MK 48 torpedoes used at the Dabob Bay Range Complex carry guidance wire The total projected number of test runs involving the different types of MK 48 torpedoes is approximately 90 per year An average of 15,000 yards of wire is expended per shot UUVs and other vehicles can expend a similar amount of fiber optic "wire" On the average, they expend 20,000 yards per exercise	There are no air emissions associated with the use of guidance wire	When a MK 48 torpedo is deployed, it releases an average of 15,000 yards or 85 pounds of guidance wire into the aquatic environment This guidance wire is not recovered The guidance wire from the MK 48 torpedo is slightly negatively buoyant, with plastic-coated copper that connects the torpedo to the launch platform and allows guided control after launch At the end of the test run, the wire is cut away from the torpedo and the launch platform, allowing the wire to sink to the bottom of the range site The possibility of copper leaching into the aquatic environment is minimal due to the plastic coating used on the guidance wire Pieces of wire recovered from the ranges shows the plastic does not degrade and only the bitter ends of the copper is reactant The fiber optic "wire" has no leaching properties and remains on the bottom in a manner similar to the copper wire	Same as above	There are no acoustic emissions associated with the use of guidance wire

ACTIVITY AND PLATFORM SYSTEM USED	ESIMATED AMOUNT	AIR QUALITY ISSUES	WATER QUALITY ISSUES	BIOLOGICAL ISSUES	ACOUSTICS/NOISE ISSUES
2) Stored Chemical Energy Propulsion System (SCEPS)					
a) MK 50 The MK 50 is an advanced lightweight torpedo for use against the faster, deeper-diving and more sophisticated submarines Its propulsion system uses lithium and sulfur hexafluoride to drive a small closed cycle steam turbine system (working fluid, distilled water) which produces no effluent The propulsion system produces a great deal of heat and thus requires special recovery efforts by helicopter or ROV	Approximately10 test runs per year are projected	MK 50 torpedoes retain reaction byproducts, and thus do not release emissions into the air The various firing craft containing the weapon systems, however, utilize diesel powered propulsion Exhaust from diesel and gas turbine engines is the primary air pollutant associated with their operation (see 3 B(1))	There are no byproducts or materials exhausted into the aquatic environment	Ongoing development and population increases in the Puget Sound and, more specifically, in the vicinity of the Dabob Bay Range Complex, may cause wildlife populations to seek refuge/habitat/food in Dabob Bay due to its undeveloped state Vessels operating within the Dabob Bay Range Complex comply with the Marine Mammal Protection Act, which protects marine mammals from being harassed, hunted, captured, or killed Prior to commencing in-water torpedo runs, it is Navy policy to establish an exclusion zone and complete a survey to ensure that there are no marine mammals within this zone Range operations also include wildlife monitoring and reporting to agencies such as the NMFS	During testing, public access to the range site is restricted to limit the amount of radiated noise into the water Vessels on the range may be asked to stop their engines during the test to ensure appropriate tracking of torpedoes Many range operations, including those involving SCEPS systems, generate noise All torpedoes utilize a 75 kHz pinger with downward focused noise to allow for tracking and a 5 to 80 kHz forward focused sonar used to "home in" on targets Standard procedures at the Dabob Bay Range Complex withhold testing activities if mammals are located within the downward or forward cones of noise
b) Torpedo Defense Vehicle (TDV) The TDVs contain the same properties as the MK 50 torpedoes, but on a much smaller scale	Approximately10 test runs per year are projected	Same as above	Same as above	Same as above	Same as above
3) Other Thermal Systems					
Experimental Thermal Systems. These systems utilize both open and closed systems Some systems will have byproducts and/or acoustics, while some will not The precise properties of these systems are undetermined at this time	Projected test runs are undetermined at this time, but are expected to be approximately 20 tests per year	Some experimental thermal systems will involve byproducts The particular properties are undetermined at this time, and warrant future analysis prior to range testing events	Some experimental thermal systems will involve byproducts The particular properties are undetermined at this time, and warrant future analysis prior to range testing events	Same as above	Same as above Some experimental thermal systems will involve noise emissions while some will not The particular properties are undetermined at this time, and warrant future analysis prior to testing

ACTIVITY AND PLATFORM/ SYSTEM USED	ESIMATED AMOUNT	AIR QUALITY ISSUES	WATER QUALITY ISSUES	BIOLOGICAL ISSUES	ACOUSTICS/NOISE ISSUES
C. SPECIAL AND EXOTIC PROPULSION SYSTEMS					
a) Rocket Propulsion System The system utilized at DBRC is the Exotic Rocket Motor Exotic propulsion systems are a form of an unmanned underwater vehicle	A projected use of approximately 12 test runs per year	The exotic propulsion systems produce exhaust components that are exhausted into the water The exhaust materials include carbon monoxide, carbon monoxide, ethane, methane, hydrogen chloride, hydrogen and nitrogen	The exotic propulsion systems produce exhaust components that are exhausted into the water The exhaust materials include carbon monoxide, carbon monoxide, ethane, methane, hydrogen chloride, hydrogen and nitrogen	Same as above	During testing, public access to the range site is restricted to limit the amount of radiated noise into the water Vessels on the range may be asked to stop their engines during the test to ensure appropriate tracking of torpedoes. Many range operations, including those involving thermal powered systems, generate noise All torpedoes utilize a 75 kHz pinger with downward focused noise to allow for tracking and a 5 to 80 kHz forward focused sonar used to "home in" on targets Standard procedures at the Dabob Bay Range Complex require suspending testing activities if mammals are located along the course of the torpedo. The Noise Control Act provides federal performance standards which are designed into new ship systems and equipment to reduce noise emission However, military aircraft, combat equipment, and weapon systems are exempt from the new product standards and retrofit modifications are not required Workplace noise is not considered environmental noise
b) Other Exotic Propulsion Systems Other exotic propulsion systems may be tested in the future Their environmental affects must be studied before they can be tested at DBRC	The projected use is part of the approximately 12 runs per year described above	The effects will need to be evaluated after the systems are defined and before they are operated	The effects will need to be evaluated after the systems are defined and before they are operated.	Same as above	Same as above
D. ELECTRIC PROPULSION SYSTEMS					
1) **General Test Vehicle (GTV)** General Tests Vehicles are a form of unmanned underwater vehicle (UUV) powered by silver-zinc batteries (but other combinations are possible, however) GTVs are used as the propulsion testbed for various sonar/torpedo projects at the Dabob Bay Range Complex	A projected use of approximately 60 test runs per year	GTVs, UUVs, and MK 30 Targets do not release emissions into the air The various support craft that deploy these systems, however, utilize diesel powered propulsion Exhaust from diesel and gas turbine engines is the primary air pollutant associated with their operation (see 3 B(1))	There are no byproducts or materials exhausted into the aquatic environment	Same as above	GTVs utilize a 75 kHz pinger with downward focused noise to allow for tracking Sonar emissions depend on what experimental package is being tested for a particular run Standard procedures at the Dabob Bay Range Complex withhold testing activities if mammals are located within the downward or forward cones of noise

	ACTIVITY AND PLATFORM/ SYSTEM USED	ESIMATED AMOUNT	AIR QUALITY ISSUES	WATER QUALITY ISSUES	BIOLOGICAL ISSUES	ACOUSTICS/NOISE ISSUES
2)	**Electric Unmanned Underwater Vehicle (UUV)** UUVs can undertake a number of testing missions including submarine warfare, anti-submarine warfare, ocean surveillance, mine warfare, special warfare, and non-combat operations	A projected use of approximately 60 test runs per year	Same as above	There are no byproducts or materials exhausted into the aquatic environment	Same as above	UUVs utilize a 75 kHz pinger with downward focused noise to allow for tracking Some UUVs emit sonar to "home in" on targets Standard procedures at the Dabob Bay Range Complex withhold testing activities if mammals are located within the downward or forward cones of noise
3)	**MK 30 Target** This is a mobile target used in fleet training It uses silver zinc batteries and an electric motor for propulsion through the water	Approximately20 test runs per year are projected	Same as above	There are no byproducts or materials exhausted into the aquatic environment	Same as above	MK 30 Targets emit noises to simulate the reflection of a torpedo's active sonar pulse off of a submarine The noise frequency ranges up to 35 kHz Standard procedures at the Dabob Bay Range Complex withhold testing activities if mammals are located within the downward or forward cones of noise
E.	**OTHER TESTING ACTIVITIES**					
1)	**Submarine Testing** Submarine testing can involve radiated noise measurement tests and general operation characteristics	Approximately45 test runs per year are projected	Diesel operations using emergency propulsion systems or surface propulsion may affect air quality	There are no byproducts or materials exhausted into the aquatic environment	Same as above	Many range operations, including fleet vessel, submarine, and aircraft use, generate noise Submarines utilize a 75 kHz pinger with downward focused noise to allow for tracking Standard procedures at the Dabob Bay Range Complex withhold testing activities if mammals are located within the downward or forward cones of noise
2)	**Mine Sweeping** Testing operations involve the use of support craft in the sweeping of mine fields	Approximately20 test runs per year are projected	Mine Sweeping, trawler exercises, Acoustic and Magnetic Array, countermeasures, impact testing, and static testing operations involve the utilization of support craft with diesel powered propulsion Engine exhaust is the primary air pollutant associated with their operation (see 3 B(1))	There are no byproducts or materials exhausted into the aquatic environment Keyport support craft utilized within the Dabob Bay Range Complex will meet Navy regulations, which include a "Zero Discharge" policy	Same as above	Mine Sweeping utilizes a helicopter or a surface vessel, both of which emit noise Standard procedures at the Dabob Bay Range Complex withhold testing activities if mammals are located within the downward or forward cones of noise
3)	**Non-Navy Testing Such as Trawler Exercises** Instrumentation for tracking above and below water systems for non-military use such as NOAA Support craft are utilized in the exercises	Approximately5 test runs per year are projected	Same as above	Same as above	Same as above	Systems may utilize a 75 kHz pinger with downward focused noise to allow for tracking Standard procedures at the Dabob Bay Range Complex withhold testing activities if mammals are located within the downward or forward cones of noise
4)	**Acoustic and Magnetic Arrays** Experimental array temporarily installed on the sea bottom for measurement of signals	Fewer than 10 test installations per year are projected	Same as above	The installation of acoustic and magnetic arrays on the sea bottom may cause minor disturbance to a localized area	Same as above	Acoustic and magnetic arrays are used for detection and do not emit noises under normal circumstances

ACTIVITY AND PLATFORM/ SYSTEM USED	ESIMATED AMOUNT	AIR QUALITY ISSUES	WATER QUALITY ISSUES	BIOLOGICAL ISSUES	ACOUSTICS/NOISE ISSUES
5) **Countermeasures** Countermeasures are devices that distract a sonar including a torpedo from its target One example is for countermeasure devices to act as a decoy to create sufficient noise to mask any sonar returns from the target	Approximately50 countermeasure tests are projected per year	Same as above	Following testing activities, countermeasures sink to the seabed and slowly decay Countermeasure devices are small, approximately 3-5 inches in diameter and 2-6 feet long	Same as above	Countermeasures emit noises intended to distract torpedoes from their target The noises emitted can be anything from a broadband mechanically generated noise to an electronically generated sweep over specific frequencies that are used by sonars Standard procedures at the Dabob Bay Range Complex withhold testing activities if mammals are located within the downward or forward cones of noise
6) **Impact tests** During normal testing of torpedoes, test units are programmed not to actually hit the target They may be programmed to turn away from the target at a predetermined point prior to impact In some cases a depth cut off or ceiling cut off are part of the program such that the weapon may pass below or above the target and commence a re-attack without turning away Physical damage to a lightweight torpedo from impact testing varies from slight damage to complete fracture of the torpedo In a significant percentage of impact shots, the MK 50 torpedo sustains enough damage to cause a breach of the outer wall of the lithium propulsion boiler If this happens, the boiler chemicals should remain contained in the inner compartments of the torpedo However, the potential does exist for a total breach of the boiler and torpedo shell, resulting the release of lithium, sulfur hexafluoride, and reaction byproducts into the water	Approximately10 impact tests per year are projected	Same as above	The potential exists for a total breach of the boiler and torpedo shell during impact testing of the MK50 torpedo, resulting in the release of lithium, sulfur hexafluoride, and reaction byproducts into the water The maximum amount of releasables is 10 pounds of lithium, and 10 pounds of sulfur hexafluoride Potential reaction byproducts from the combustion products include lithium carbide, lithium carbonate, lithium chloride, lithium fluoride, lithium hydride, lithium hydroxide, lithium sulfide, potassium chloride, and sulfur From the rest of the torpedo one can expect many types of byproducts from reaction with the hull, plastics, electronics etc Lithium and some of its compounds react violently in water and many lithium compounds are caustic when in solution This has occurred less than 1 percent of the range shots and of these approximately 5 percent have breached	Same as above	The impact point of these tests will create noises underwater, particularly if a total breach of the boiler and torpedo shell occur (resulting in the release of lithium, sulfur hexafluoride, and reaction byproducts into the water) Impact tests will likely occur on a very infrequent basis, if at all Chances of a total breach of the boiler and torpedo shell during impact testing are unlikely Standard procedures at the Dabob Bay Range Complex withhold testing activities if mammals are located within the downward or forward cones of noise
7) **Static testing in water** The Acoustic Platform for Experiments (APEX) test involves static testing This platform is located in Dabob Bay and has historically been used for research and development of instrumented underwater vehicles It is available for use but is seldom used The platform holds the test vehicle underwater in a stationary position while the propulsion system is operated using load disks rather than propellers For Otto Fuel II propulsion systems, this creates a unique situation where gases are exhausted in a small area	Approximately10 tests per year are projected	Same as above	For Otto Fuel II propulsion systems, static testing in water creates a situation where gases are exhausted in a small area Consequently, the concentration of gas contaminants in this area will be initially elevated When planning a test using this platform the exhaust components are accounted for and concentrations will be calculated to determine safe observation distances and possible effects	Same as above	Static testing can involve testing of great variety of systems, thus may involve acoustic emissions Standard procedures at the Dabob Bay Range Complex withhold testing activities if mammals are located within the downward or forward cones of noise

ACTIVITY AND PLATFORM/ SYSTEM USED	ESIMATED AMOUNT	AIR QUALITY ISSUES	WATER QUALITY ISSUES	BIOLOGICAL ISSUES	ACOUSTICS/NOISE ISSUES
8) SONAR Tests SONAR testing from boats or aircraft involve operations of the sonar against fixed or mobile, real or artificial targets to verify performance	Approximately 20 per year	Same as above	None	Same as above	SONARS emit noises requiring careful monitoring for marine mammal activity in the area
II. System Recovery					
A. BUOYANCY SYSTEMS					
1) Positive Buoyancy Systems This includes the MK 48 Torpedoes, which are automatically buoyant	Approximately 55% of all test units launched are positively buoyant (approximately 150 per year)	This system does not release any emissions into the air	This system does not release any emissions or debris into the water	There have been no "observed biological effects" associated with this system	No noise emissions are associated with this system
2) Active Buoyancy Systems This involves an end of run bag to be inflated by using Nitrogen or Carbon Dioxide to float the test unit	Approximately 40% of all test units launched contain active buoyancy systems (approximately110 per year)	After test units are recovered from the surface of the water, the Nitrogen or Carbon Dioxide within the bags are allowed to vent into the air	This system does not release any emissions or debris into the water	There have been no "observed biological effects" associated with this system	No noise emissions are associated with this system
3) Dropper Systems Some weapon systems, such as the MK 46 variants, drop lead ballast at the end of each run to achieve positive buoyancy	Approximately30 tests per year	This system does not release any emissions into the air	Lead droppers remain on the bottom	There have been no "observed biological effects" associated with this system	No noise emissions are associated with this system
4) Negative Buoyancy Systems (Bottom Recovery)					
a) Buried Test Units Buried test units are retrieved using the Submerged Object Recovery Device (SORD), which are anchored to the sea bottom and utilize a suction system The components of the SORD system consist of the vehicle, control consoles, hydraulic power pack, umbilical winch system, and three kedging winches To deploy the vehicle, the firing/recovery craft must be in a three point moor SORD is maneuvered with 3 kedge wires SORDs are capable of recovering units up to a depth of 30 feet in the sediment	Approximately 5% of systems tested at the Dabob Bay Range Complex require bottom recovery (approximately14 per year) A minority of the test units end up being buried within the seabed and require the SORDs use	Remotely Operated Vehicles, including SORD, used to locate and retrieve torpedoes, do not release emissions into the air The firing/recovery craft, however, used to deploy the operations utilize diesel powered propulsion Exhaust from diesel and gas turbine engines is the primary air pollutant associated with their operation (see 3 B(1))	This operation disrupts the seabed in a localized area and causes a short-term effect on the water quality in the area of the operation	The infrequent requirement to recover a buried test unit will cause a short term disturbance to the sea bed	All ROVs have 75 kHz pingers for tracking Standard procedures at the Dabob Bay Range Complex withhold testing activities if mammals are located within the downward or forward cones of noise

ACTIVITY AND PLATFORM/ SYSTEM USED	ESIMATED AMOUNT	AIR QUALITY ISSUES	WATER QUALITY ISSUES	BIOLOGICAL ISSUES	ACOUSTICS/NOISE ISSUES
b) Unburied Test Units Most of the test units are found laying on top of the bottom sediment and can be recovered with only minimal disruption of the seabed These bottom recoveries involve the use of cable controlled, free swimming ROVs, including the Tethered Remotely Operated Vehicle (TROV-N) and the Sea Rover	Approximately 5% of systems tested at the Dabob Bay Range Complex require bottom recovery (approximately14 per year) Of the 5%, most are unburied	Same as above	Test units found lying on top of the bottom sediment can be recovered with only minimal disruption of the seabed	Bottom recoveries will cause a minor, short term disturbance to the sea bed These areas are usually deep and not populated with animal life	All ROVs have 75 kHz pingers for tracking Standard procedures at the Dabob Bay Range Complex withhold testing activities if mammals are located within the downward or forward cones of noise
III. Range Support Activities					
A. FLEET OPERATIONS					
1) Surface ship operation Fleet vessels used at the Dabob Bay Range Complex include Frigates, cruisers and destroyers	Approximately10 fleet surface ships are projected to utilize the area per year	Navy combatants use a variety of propulsion systems Exhaust from diesel and gas turbine engines is the primary air pollutant associated with the operation of surface ships Navy regulations and policy ensures air emissions from Navy vessels are reduced to acceptable levels and that they are regulated to an equal or more stringent degree relative to private vessels Navy policy reduces concerns of the use of volatile substances aboard ships by requiring ships pierside to implement operation and maintenance procedures to prevent stack emissions that violate state and local regulations and to minimize the operation of boilers and diesel engines by using shore provided hotel services	Any fleet vessels that will be utilized for testing will meet Navy regulations The Navy maintains a zero discharge policy at the Dabob Bay Range Complex	The infrequent nature of range usage by fleet vessel operations is such that the overall effects are minimized	Many range operations, including fleet vessel, submarine, and aircraft use, generate noise The Noise Control Act provides federal performance standards which are designed into new ship systems and equipment to reduce noise emission However, military aircraft, combat equipment, and weapon systems are exempt from the new product standards and retrofit modifications are not required Workplace noise is not considered environmental noise
2) Submarine operation Fleet submarines used at the Dabob Bay Range Complex include SSN, SSBN, and SS (Diesel-electric)	Submarines are projected to utilize the area approximately 30 times per year	Submarines normally use nuclear power which does not create air emissions	Submarines will not discharge any substance during range operations	The infrequent nature of range usage by submarines is such that the overall effects are minimized	Same as above
3) Aircraft operation Fleet aircraft used at the Dabob Bay Range Complex include but are not limited to SH-60, Hughes 500D, Sikorsky model S61Land P-3	Approximately30 aircraft operations are projected in the area per year	Engine exhaust at altitude is the primary air pollutants associated with the operation of aircraft	The routine operation of aircraft at Northwest range sites involves no discharges to water Since Dabob Bay Range Complex operations require aircraft to be at fairly low altitude an emergency discharge could affect local water quality	The infrequent nature of range usage by fleet aircraft operations is such that the overall effects are minimized	Same as above

ACTIVITY AND PLATFORM/ SYSTEM USED	ESIMATED AMOUNT	AIR QUALITY ISSUES	WATER QUALITY ISSUES	BIOLOGICAL ISSUES	ACOUSTICS/NOISE ISSUES
B. KEYPORT OPERATIONS					
1) Support craft operation Keyport currently maintains support craft ranging in size from the 186 foot Yard Torpedo Test vessel to the 13 foot special projects boat Activities can include target and acoustic services, recovery services, cable laying and range maintenance services, weapon firing and retrieval, diver tending, range security, and community emergencies/relations Support craft used at the Dabob Bay Range Complex include Yard Torpedo Tender (YTT) Torpedo Retrieval Boat (TRB) Yard Patrol (YP) Motorized Barge Miscellaneous support craft	As needed for testing	Support craft use a variety of propulsion systems Exhaust from diesel and gas outboard engines is the primary air pollutant associated with the operation of surface ships Navy regulations and policies ensure air emissions from Navy vessels are reduced to acceptable levels and that they are regulated to an equal or more stringent degree relative to private vessels Navy policy reduces concerns of the use of volatile substances aboard ships by requiring ships pierside to implement operation and maintenance procedures to prevent stack emissions that violate state and local regulations and to minimize the operation of boilers and diesel engines by using shore provided hotel services	All Keyport support craft utilized within the Dabob Bay Range Complex will meet Navy regulations, which include a "Zero Discharge" policy Thus solid waste, oily waste, sewage, medical waste, and hazardous materials and waste must be retained on board for shore use or proper disposal	Navy policies prohibiting or minimizing (see left) the discharge of solid waste, sewage, medical waste, oil, and hazardous waste and materials into the aquatic environment minimize the associated biological effects	Same as above
Buoy use Anchors are used for vessel moorage when the vessel must remain stationary during testing operations The moorings are also used during recovery and other operations when an exact position must be maintained The anchors are pyramid-shaped with a 1 6-inch diameter nylon mooring line connecting the anchor with a surface-mooring buoy The shape of the anchors allows deep penetration into the soft sediment, ensuring that the vessel is adequately secured to the range site bottom Buoy anchors are 6000-lb diamond-shaped lead anchors They are generally planted and retrieved by the YTTs	One semi-permanent buoy is placed near the Zelatched Pier All other buoys are utilized as needed for testing operations	No air emissions are associated with buoy anchors	The lead anchors fall into an anaerobic condition in the sediment Actions have been taken to minimize the loss of these anchors including changes in anchor design and retrieval practices, and increasing the diameter of the anchor line Raising procedures have been revised to slow the ascent of the anchor, and methods have been devised to rock the anchor to dislodge it from the soft sediment	See left	No noise emissions are associated with buoy anchors
2) Operation of shore facilities This includes general shore activities such as fueling, limited loading and storage activities, and the operation of office and computer facilities	Shore facility operations occur on a daily basis throughout the year	Support vessels that require diesel are fueled at the service pier at Bangor or off-site at public facilities Fueling at the service pier is completed during daylight hours with the vessel entirely enclosed by oil containment booms When fueling at a remote site, all applicable safety precautions and local authority guidelines are allowed	Operations are controlled at these facilities to prevent any release of materials into the water	Disturbances caused by general shore operations may affect the inhabitants of the Dabob Bay Range Complex	The use of powered tools, machinery or other shore operations equipment that emit excessive noises, either directly or indirectly, is restricted to normal daylight working hours to the maximum extent possible Navy personnel engaged in processes that result in environmental noise at shore activities are required to receive training on noise pollution reduction

ACTIVITY AND PLATFORM/ SYSTEM USED	ESIMATED AMOUNT	AIR QUALITY ISSUES	WATER QUALITY ISSUES	BIOLOGICAL ISSUES	ACOUSTICS/NOISE ISSUES
3) Operation of underwater recovery equipment In addition to recovering weapon systems from the bottom, underwater recovery vehicles are used to service deployed instrumentation As the vehicles receive electrical power and control signals from a surface platform via an umbilical, there are no air emissions associated with the routine operation of this equipment	Less than 120 operations per year	There are no air emissions associated with the routine operation of underwater recovery equipment	The routine operation of underwater recovery equipment (ROVs) is expected to result in minimal discharge of pollutants into the water Residual oil from the manufacturing and storage of the steel kedge wire used for the deployment of the SORD vehicle may be emitted into the water Recoveries requiring dredging or excavating total only a small percentage of all underwater recoveries	The operation of underwater recovery equipment will cause a short-term disturbance to the seabed These areas, however, are usually deep and not populated with animal life	All ROVs have 75 kHz pingers for tracking Standard procedures at the Dabob Bay Range Complex withhold testing activities if mammals are located within the downward or forward cones of noise
4) Operation of acoustic acquisition equipment Acoustic measurements at the Dabob Bay Range Complex include the measurement and recording of ambient noise, radiated self-noise, active noise, and sonar noise Hydrophone systems are used to acquire acoustic data from key events such as torpedo starts, runs, shutdowns, and squib initiations which are returned to Keyport for analysis Hydrophones can also serve other purposes Specific equipment includes the Noise Recording System (NRS) and the Bottom-Moored Array (BMA)	The NRS4 is deployed 50% of all test runs (less than 135 per year) The BMA is permanently bottom-deployed	There are no air emissions associated with the routine operation of any acoustic acquisition equipment NRS is deployed from a range craft which is powered by diesel engines	The routine operation of acoustic acquisition equipment at the Dabob Bay Range Complex involves no discharges	The depths to which BMAs are employed typically have little or no animal life	The purpose of these systems is to measure and record ambient noise, radiated self-noise, active noise, and sonar noise Hydrophone systems are used to acquire acoustic data from key events such as torpedo starts, runs, shutdowns, and squib initiations which are returned to Keyport for analysis
5) Operation of range tracking equipment Acoustic measurements at the Dabob Bay Range Complex are obtained using underwater sonar (75 kHz pingers) and above water GPS	Range tracking equipment is utilized for testing events	There are no air emissions associated with the routine operation of any range tracking equipment	The routine operation of range tracking equipment involves no discharges	There are no air or water emissions, associated with the routine operation of range tracking equipment	Acoustic measurements at the Dabob Bay Range Complex are obtained using underwater sonar (75 kHz pingers) and above water GPS
6) Operation of targets Both stationary and mobile targets are used to support the evaluation of a weapon system's ASW capabilities Stationary targets are suspended off of barges The MK 30 Target is one example of a mobile target	Stationary targets are utilized in approximately 70% of testing approximately 190 per year), while mobile targets are utilized in only 10% of testing events (approximately27 per year)	There are no air emissions associated with the routine operation of targets	The routine operation of stationary target equipment at the Dabob Bay Range Complex involves no discharges Mobile targets are considered like other vehicles with battery propulsion The MK 30 target expends three small plastic pieces while it is deploying its towed array All efforts are made to recover these buoyant pieces	Standard Navy procedures withhold testing activities if mammals are located within the downward or forward cones of noise	Both target systems emit sonar noises Standard procedures at the Dabob Bay Range Complex withhold testing activities if mammals are located within the downward or forward cones of noise

Appendix B

Tribal Consultation

DEPARTMENT OF THE NAVY
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5090
Ser 05EP-KK/5316
OCT 2 6 1999

Denny Hurtado
Chairman
Skokomish Tribe
North 80 Tribal Center Road
Shelton, Washington 98584

Dear Mr. Hurtado:

The Navy is conducting an assessment of cultural and tribal resources for implementation of the proposed Dabob Bay Area Range Operations and Management Plan (OMP). Potential cultural resources addressed in this study include archaeological sites, historic structures, and traditional cultural properties. Tribal resources include tribal fishery resources and fisheries activities involving shrimp, salmon, clams, and other natural resources in the project area. The Dabob Bay Area Range OMP addresses ongoing underwater test vehicle activities currently being conducted at the Dabob Bay Military Operating Area (MOA), the South Hood Canal MOA, the North Hood Canal MOA, Zelatched Point land-based facility, the Whitney Point land-based facility, and connecting waters between them (Figure 1). The Navy wants to ensure continued test range operations through adoption of the proposed Dabob Bay Area Range OMP. In general, the OMP addresses only those activities that are currently taking place under Navy direction in Dabob Bay. The only new activities proposed involve the transitioning of underwater test vehicles between the Hood Canal MOA's and Dabob Bay.

Current operations include loading, launching, tracking, and retrieval of underwater test vehicles including inert torpedoes. Occasionally these underwater vehicles are retrieved from the water surface or from the sea floor. Examples of potential impacts include occasional loss of guidance wire/fiber optic cable in bottom muck and standard pollution related to boat operation. The Navy is preparing an environmental assessment (EA) on the potential impacts of Dabob Bay Area Range OMP implementation. The Navy's contractor, Larson Anthropological Archaeological Services Limited (LAAS) is responsible for addressing potential impacts of shoreline activities and access on archaeological resources, historic structures, and traditional cultural properties and of underwater activities on submerged archaeological resources, including shipwrecks and archaeological sites. In addition, LAAS will also gather information on the potential impacts to tribal shellfish harvesting and shrimping and Tribal salmon and other finfish harvest.

The Navy's cultural resource assessment for the project currently consists of archival and literature review, tribal consultation and production of a technical report. We are currently gathering existing archaeological, historic, ethnographic, and historic Indian data from the Washington State Office of Archaeology and Historic Preservation and the University of

Washington Libraries. However, we are aware that the Skokomish Tribe may have information gathered from elders and/or the Tribe areas that may currently be used for traditional cultural activities. We also request information relevant to any historic structures or properties that may have importance to the Tribe that are in the proposed project area.

We encourage the Skokomish Tribe's cultural representative to contact us if the Tribe has information that might be useful in our records check. We recognize that traditional cultural use areas are private, but would welcome the opportunity to work with the Tribe regarding incorporation of this type of information in a secure and respectful manner. Navy is also seeking information relative to Tribal fisheries activity in the Dabob Bay Area Range OMP project area. We will be relying upon you and your fisheries expertise and knowledge to quantify and characterize fishing activity in the project area. We request information regarding types and frequency of fishing activity, and if appropriate, places where salmon harvest, clam harvest, and shrimp harvest are conducted by Skokomish Tribal members in the project area. Our point of contact for this project is Leonard Forsman who can be reached at 1-888-631-6131 or at laasltd@ibm.net. Otherwise, Mr. Forsman will contact the Tribe's fisheries representative within the next two weeks.

Sincerely,

Neil Bass

NEIL BASS
Deputy Environmental Director

Copy to:
Genny Rogers, Cultural Resource Specialist, Skokomish Tribe
David Herrera, Fisheries Manager, Skokomish Tribe
Leonard Forsman, LAAS

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5090
Ser 05EP-KK/5315
OCT 26 1999

Ron Charles
Chairperson
Port Gamble S'Klallam Tribe
31912 Little Boston Road
Kingston, Washington 98346

Dear Mr. Charles:

The Navy is conducting an assessment of cultural and tribal resources for implementation of the proposed Dabob Bay Area Range Operations and Management Plan (OMP). Potential cultural resources addressed in this study include archaeological sites, historic structures, and traditional cultural properties. Tribal resources include tribal fishery resources and fisheries activities involving shrimp, salmon, clams, and other natural resources in the project area. The Dabob Bay Area Range OMP addresses ongoing underwater test vehicle activities currently being conducted at the Dabob Bay Military Operating Area (MOA), the South Hood Canal MOA, the North Hood Canal MOA, Zelatched Point land-based facility, the Whitney Point land-based facility, and connecting waters between them (Figure 1). The Navy wants to ensure continued test range operations through adoption of the proposed Dabob Bay Area Range OMP. In general, the OMP addresses only those activities that are currently taking place under Navy direction in Dabob Bay. The only new activities proposed involve the transitioning of underwater test vehicles between the Hood Canal MOA's and Dabob Bay.

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Washington Libraries. However, we are aware that the Port Gamble S'Klallam Tribe may have information gathered from elders and/or the Tribe areas that may currently be used for traditional cultural activities. We also request information relevant to any historic structures or properties that may have importance to the Tribe that are in the proposed project area.

We encourage the Port Gamble S'Klallam Tribe's cultural representative to contact us if the Tribe has information that might be useful in our records check. We recognize that traditional cultural use areas are private, but would welcome the opportunity to work with the Tribe regarding incorporation of this type of information in a secure and respectful manner. Navy is also seeking information relative to Tribal fisheries activity in the Dabob Bay Area Range OMP project area. We will be relying upon you and your fisheries expertise and knowledge to quantify and characterize fishing activity in the project area. We request information regarding types and frequency of fishing activity, and if appropriate, places where salmon harvest, clam harvest, and shrimp harvest are conducted by Port Gamble S'Klallam Tribal members in the project area. Our point of contact for this project is Leonard Forsman who can be reached at 1-888-631-6131 or at laasltd@ibm.net. Otherwise, Mr. Forsman will contact the Tribe's fisheries representative within the next two weeks.

Sincerely,

Neil Bass

NEIL BASS
Deputy Environmental Director

Copy to:
Marie Hebert, Tribal Council Member, Port Gamble S'Klallam Tribe
Scott Brewer, Fisheries Biologist, Port Gamble S'Klallam Tribe
Leonard Forsman, LAAS

DEPARTMENT OF THE NAVY
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5090
Ser 05EP-KK/5314
OCT 26 1999

Russ Hepfer
Chairpman
Lower Elwha Klallam Tribe
2851 Lower Elwha Road
Port Angeles, Washington 98362

Dear Mr. Hepfer:

The Navy is conducting an assessment of cultural and tribal resources for implementation of the proposed Dabob Bay Area Range Operations and Management Plan (OMP). Potential cultural resources addressed in this study include archaeological sites, historic structures, and traditional cultural properties. Tribal resources include tribal fishery resources and fisheries activities involving shrimp, salmon, clams, and other natural resources in the project area. The Dabob Bay Area Range OMP addresses ongoing underwater test vehicle activities currently being conducted at the Dabob Bay Military Operating Area (MOA), the South Hood Canal MOA, the North Hood Canal MOA, Zelatched Point land-based facility, the Whitney Point land-based facility, and connecting waters between them (Figure 1). The Navy wants to ensure continued test range operations through adoption of the proposed Dabob Bay Area Range OMP. In general, the OMP addresses only those activities that are currently taking place under Navy direction in Dabob Bay. The only new activities proposed involve the transitioning of underwater test vehicles between the Hood Canal MOA's and Dabob Bay.

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Washington Libraries. However, we are aware that the Lower Elwha Klallam Tribe may have information gathered from elders and/or the Tribe areas that may currently be used for traditional cultural activities. We also request information relevant to any historic structures or properties that may have importance to the Tribe that are in the proposed project area.

We encourage the Lower Elwha Klallam Tribe's cultural representative to contact us if the Tribe has information that might be useful in our records check. We recognize that traditional cultural use areas are private, but would welcome the opportunity to work with the Tribe regarding incorporation of this type of information in a secure and respectful manner. Navy is also seeking information relative to Tribal fisheries activity in the Dabob Bay Area Range OMP project area. We will be relying upon you and your fisheries expertise and knowledge to quantify and characterize fishing activity in the project area. We request information regarding types and frequency of fishing activity, and if appropriate, places where salmon harvest, clam harvest, and shrimp harvest are conducted by Lower Elwha Klallam Tribal members in the project area. Our point of contact for this project is Leonard Forsman who can be reached at 1-888-631-6131 or at laasltd@ibm.net. Otherwise, Mr. Forsman will contact the Tribe's fisheries representative within the next two weeks.

Sincerely,

Neil Bass

NEIL BASS
Deputy Environmental Director

Copy to:
Matt Burns, Environmental Coordinator, Lower Elwha Klallam Tribe
Georgianne Charles, Cultural Resources Director, Lower Elwha Klallam Tribe
Pat Crain, Fisheries Director, Lower Elwha Klallam Tribe
Leonard Forsman, LAAS

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5090
Ser 05EP-KK/5313
OCT 2 6 1999

W. Ron Allen
Chairperson
Jamestown S'Klallam Tribe
1033 Old Blyn Highway
Sequim, Washington 98382

Dear Mr. Allen:

The Navy is conducting an assessment of cultural and tribal resources for implementation of the proposed Dabob Bay Area Range Operations and Management Plan (OMP). Potential cultural resources addressed in this study include archaeological sites, historic structures, and traditional cultural properties. Tribal resources include tribal fishery resources and fisheries activities involving shrimp, salmon, clams, and other natural resources in the project area. The Dabob Bay Area Range OMP addresses ongoing underwater test vehicle activities currently being conducted at the Dabob Bay Military Operating Area (MOA), the South Hood Canal MOA, the North Hood Canal MOA, Zelatched Point land-based facility, the Whitney Point land-based facility, and connecting waters between them (Figure 1). The Navy wants to ensure continued test range operations through adoption of the proposed Dabob Bay Area Range OMP. In general, the OMP addresses only those activities that are currently taking place under Navy direction in Dabob Bay. The only new activities proposed involve the transitioning of underwater test vehicles between the Hood Canal MOA's and Dabob Bay.

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The Navy's cultural resource assessment for the project currently consists of archival and literature review, tribal consultation and production of a technical report. We are currently gathering existing archaeological, historic, ethnographic, and historic Indian data from the Washington State Office of Archaeology and Historic Preservation and the University of

Washington Libraries. However, we are aware that the Jamestown S'Klallam Tribe may have information gathered from elders and/or the Tribe areas that may currently be used for traditional cultural activities. We also request information relevant to any historic structures or properties that may have importance to the Tribe that are in the proposed project area.

We encourage the Jamestown S'Klallam Tribe's cultural representative to contact us if the Tribe has information that might be useful in our records check. We recognize that traditional cultural use areas are private, but would welcome the opportunity to work with the Tribe regarding incorporation of this type of information in a secure and respectful manner. Navy is also seeking information relative to Tribal fisheries activity in the Dabob Bay Area Range OMP project area. We will be relying upon you and your fisheries expertise and knowledge to quantify and characterize fishing activity in the project area. We request information regarding types and frequency of fishing activity, and if appropriate, places where salmon harvest, clam harvest, and shrimp harvest are conducted by Jamestown S'Klallam Tribal members in the project area. Our point of contact for this project is Leonard Forsman who can be reached at 1-888-631-6131 or at laasltd@ibm.net. Otherwise, Mr. Forsman will contact the Tribe's fisheries representative within the next two weeks.

Sincerely,

Neil Bass

NEIL BASS
Deputy Environmental Director

Copy to:
Kathy Duncan, Cultural Resource Specialist, Jamestown S'Klallam Tribe
Brad Sele, Fisheries Manager, Jamestown S'Klallam Tribe
Leonard Forsman, LAAS

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5090
Ser 05EP-KK/5317
OCT 26 1999

Bennie Armstrong
Chairperson
Suquamish Tribe
P.O. Box 498
Suquamish, Washington 98392

Dear Mr. Armstrong:

The Navy is conducting an assessment of cultural and tribal resources for implementation of the proposed Dabob Bay Area Range Operations and Management Plan (OMP). Potential cultural resources addressed in this study include archaeological sites, historic structures, and traditional cultural properties. Tribal resources include tribal fishery resources and fisheries activities involving shrimp, salmon, clams, and other natural resources in the project area. The Dabob Bay Area Range OMP addresses ongoing underwater test vehicle activities currently being conducted at the Dabob Bay Military Operating Area (MOA), the South Hood Canal MOA, the North Hood Canal MOA, Zelatched Point land-based facility, the Whitney Point land-based facility, and connecting waters between them (Figure 1). The Navy wants to ensure continued test range operations through adoption of the proposed Dabob Bay Area Range OMP. In general, the OMP addresses only those activities that are currently taking place under Navy direction in Dabob Bay. The only new activities proposed involve the transitioning of underwater test vehicles between the Hood Canal MOA's and Dabob Bay.

Current operations include loading, launching, tracking, and retrieval of underwater test vehicles including inert torpedoes. Occasionally these underwater vehicles are retrieved from the water surface or from the sea floor. Examples of potential impacts include occasional loss of guidance wire/fiber optic cable in bottom muck and standard pollution related to boat operation. The Navy is preparing an environmental assessment (EA) on the potential impacts of Dabob Bay Area Range OMP implementation. The Navy's contractor, Larson Anthropological Archaeological Services Limited (LAAS) is responsible for addressing potential impacts of shoreline activities and access on archaeological resources, historic structures, and traditional cultural properties and of underwater activities on submerged archaeological resources, including shipwrecks and archaeological sites. In addition, LAAS will also gather information on the potential impacts to tribal shellfish harvesting and shrimping and Tribal salmon and other finfish harvest.

The Navy's cultural resource assessment for the project currently consists of archival and literature review, tribal consultation and production of a technical report. We are currently gathering existing archaeological, historic, ethnographic, and historic Indian data from the Washington State Office of Archaeology and Historic Preservation and the University of

Washington Libraries. However, we are aware that the Suquamish Tribe may have information gathered from elders and/or the Tribe areas that may currently be used for traditional cultural activities. We also request information relevant to any historic structures or properties that may have importance to the Tribe that are in the proposed project area.

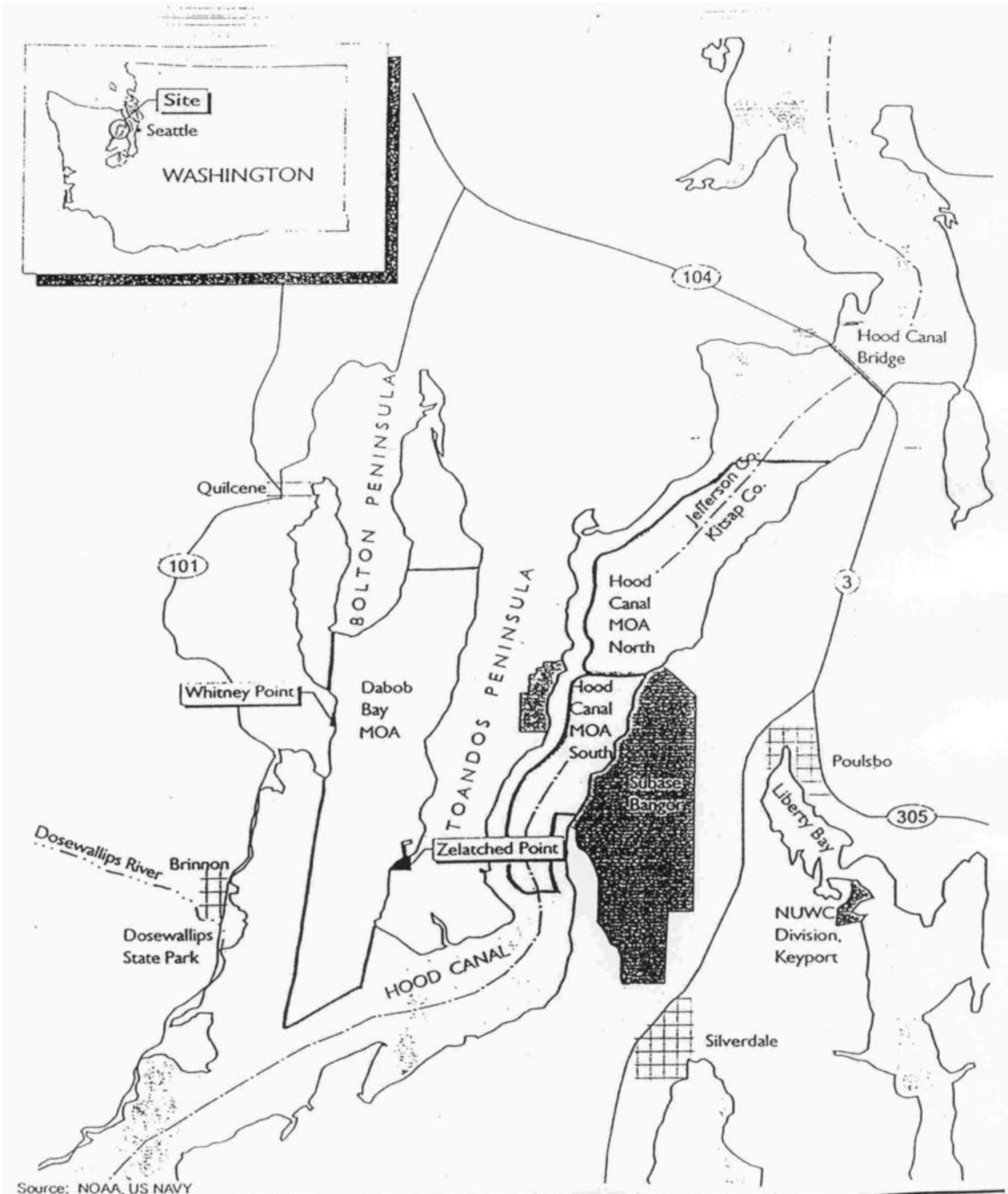
We encourage the Suquamish Tribe's cultural representative to contact us if the Tribe has information that might be useful in our records check. We recognize that traditional cultural use areas are private, but would welcome the opportunity to work with the Tribe regarding incorporation of this type of information in a secure and respectful manner. Navy is also seeking information relative to Tribal fisheries activity in the Dabob Bay Area Range OMP project area. We will be relying upon you and your fisheries expertise and knowledge to quantify and characterize fishing activity in the project area. We request information regarding types and frequency of fishing activity, and if appropriate, places where salmon harvest, clam harvest, and shrimp harvest are conducted by Suquamish Tribal members in the project area. Our point of contact for this project is Leonard Forsman who can be reached at 1-888-631-6131 or at laasltd@ibm.net. Otherwise, Mr. Forsman will contact the Tribe's fisheries representative within the next two weeks.

Sincerely,

Neil Bass

NEIL BASS
Deputy Environmental Director

Copy to:
Charles Sigo, Tribal Curator, Suquamish Tribe
Randy Hatch, Fisheries Director, Suquamish Tribe
Leonard Forsman, LAAS



Military Facilities in the Dabob Bay/Hood Canal Vicinity

Figure 1

Nov-15-99 04:37P L A A S 253 858 1410 P.02
SKOKOMISH FISHERIES ID:206-877-5148 NOV 15 '99 15:10 No.002 P.02

Skokomish Natural Resources

Telephone: (360) 877-5213 Fax: (360) 877-5148
N.541 Tribal Center Road Shelton, WA 98584

11/15/99

Mr. Neil Bass,
Deputy Environmental Director,
Northwest Naval Facilities Engineering Command
19917 7th Avenue NE
Poulsbo, WA 98370-7570

Dear Mr. Bass

The Skokomish Tribe is in receipt of your letter dated 10/26/99 in reference to the Dabob Bay Operations and Management Plan (OMP). The area encompassed by your North and South Hood Canal MOA's contain at least six sites of former seasonal fishing camps or villages. Cultural sites 103,104,175, & 176 as detailed in The Structure of Twana Culture (Elmendorf 1960) are also located within this area. In addition there are numerous shellfish gathering areas, as well as important marine salmon, geoduck, shrimp, and crab fishing areas that are of great cultural and economic importance to the Skokomish Tribe. While the protection each of these sites is important, your proposed activities in our marine fishing areas give us the most concern with regards to potential impact on Skokomish cultural resources. In order to assess these potential impacts, we require answers to the following questions:

1. Do you plan to close the MOA's to entry by Tribal fishermen during your operations?
2. How many days per year will this take place?
3. What time of year do your activities take place?
4. If closure is required during naval activities, how many hours per day of activity will there actually be naval ships present in the MOA's

It is important that the Skokomish Tribe and the Navy come to an accord with regard to a schedule for activities within the MOA's that does not disrupt our Salmon, Geoduck, Crab, and Shrimp fisheries. To that end, we propose a series of meetings to lay out Naval activities and Tribal fishing plans side by side in order to identify and resolve potential conflicts. Please contact our Fisheries Manager, Mr. David Herrera in order to arrange a meeting.

Sincerely,

Jim Park
Director, Skokomish Natural Resources

Cc: Leonard Forsman, LAAS
David Herrera, Skokomish Fisheries Manager
Genny Rogers, Skokomish Cultural Resource Technician
Skokomish Culture Committee
Skokomish Fish Committee

Memorandum

To: Joe Cloud, EDAW, Incorporated

From: Leonard Forsman, Archaeologist, Larson Anthropological Archaeological Services Limited

Subject: Summary of Tribal Consultation on Fisheries for Dabob Bay Range Area Operations and Management Plan

Date: November 18, 1999

Larson Anthropological Archaeological Services Limited consulted with the Skokomish Tribe, Port Gamble S'Klallam Tribe, Jamestown S'Klallam Tribe, Lower Elwha S'Klallam Tribe, and the Suquamish Tribe on fisheries in the Dabob Bay Range Area that includes Dabob Bay and the mainstem of Hood Canal. Comments from each Tribe are summarized below.

Skokomish Tribe

David Herrera, Fisheries Manager, Skokomish Tribe stated in a telephone conversation on November 9, 1999 that he was speaking to cultural resource and natural resource representatives from the Tribe and would prepare a letter summarizing their comments. The Skokomish Tribe wrote a letter to the U.S. Navy outlining their concerns and requesting a meeting with the U.S. Navy to discuss their concerns. The Tribe's primary issue as stated in the letter related to the closure of the Dabob Bay Range Area to tribal fishing during testing activities.

Port Gamble S'Klallam Tribe

Scott Brewer, Fisheries Biologist, Port Gamble S'Klallam Tribe provided comments in a telephone conservation on November 15, 1999. Mr. Brewer noted that the Port Gamble S'Klallam Tribe harvests salmon, shrimp, crab, intertidal bivalves (e.g. clams and oysters), and geoduck in the Dabob Bay Range Area. He said that the Skokomish Tribe has the most fishing activity in the area compared to other Hood Canal tribes.

The primary salmon species harvested by the Port Gamble S'Klallam in the Dabob Bay Range Area are chinook, coho, and chum. Salmon are harvested with drift gill nets and set nets. Chinook are harvested in late July and August on the western shore of the mainstem of Hood Canal opposite Bangor. Coho are harvested primarily in September at Point Whitney, Quilcene Bay, Dabob Bay and on the Bangor side of Hood Canal. Chums are taken in October and November on the east side of the Hood Canal mainstem at Bangor and at Dabob Bay.

A variety of shellfish are also harvested by the Port Gamble S'Klallam in the Dabob Bay Range Area. Shrimp are harvested in Dabob Bay and Quilcene Bay. Crabs are taken in Dabob Bay. Intertidal bivalves are taken on publicly owned beaches on Quilcene Bay and Bolton Peninsula. A geoduck tract available for Tribal harvest is off Hazel Point. Port Gamble S'Klallam Tribal fishermen moor their boats at Pleasant Harbor.

Mr. Brewer stated that the U.S. Navy has shut down fishing in the Dabob Bay Range Area in the past for torpedo testing and for submarine passage. The shutdowns have been an irritant to Tribal fishermen and submarines have damaged fishing nets. Mr. Brewer stated that the Port Gamble S'Klallam Tribe is interested in determining if the U.S. Navy could provide more notice than has been issued in the past. U.S. Navy orders to clear the Dabob Bay Range Area often allow only ten minutes for vessels to evacuate. The Tribe would prefer at least a 24 hours notice of impending tests. If one day warnings are not feasible, the Tribe asks that the U.S. Navy schedule their tests to avoid the times of intense Tribal fishery activity.

Mr. Brewer described salmon enhancement activities in Hood Canal. The Washington Department of Fisheries, United States Fish and Wildlife, and the Point No Point Treaty Council operate a floating coho net pen at Quilcene. The Port Gamble S'Klallam Tribe operates a hatchery in Port Gamble Bay, the Skokomish Tribe operates a hatchery at Enetai Creek, the State of Washington runs a hatchery at Hoodsport, the State of Washington operates the George Adams Hatchery on the Skokomish River, and currently, two summer chum supplementation operations are conducted at Quilcene and Big Beef creeks.

Jamestown S'Klallam Tribe

Brad Sele, Fisheries Manager, Jamestown S'Klallam Tribe stated in a telephone conversation on November 10, 1999, that he had no comments concerning fisheries in the Dabob Bay Range Area. He referred calls concerning habitat to Byron Rot, Habitat Biologist who also has not provided any comments.

Lower Elwha Klallam Tribe

Pat Crain, Fisheries Manager, Lower Elwha Klallam Tribe provided comments in a telephone conversation on November 15, 1999. Mr. Crain noted that the types of tribal fishing conducted in the Dabob Bay Range Area were similar among all the participating tribes. The Lower Elwha Klallam Tribe harvests salmon, clams, oysters, crab, shrimp, octopus, green sea urchin, and sea cucumbers in the vicinity of the Dabob Bay Range Area. There is also a potential future geoduck harvest in the area.

Mr. Crain described Lower Elwha Klallam salmon fisheries in the Dabob Bay Range Area. Chinook are fished in August with set gill nets and with trollers. Coho are harvested between September and October with beach seines, by trolling, and with set nets. Some coho are harvested in Dabob Bay but most are taken in Quilcene Bay. Lower Elwha Klallam Tribal participation in the coho fishery has been limited in recent years. The Skokomish and Port Gamble S'Klallam Tribes have been most active in the coho fishery. Chums are caught with set

DABOB BAY AND HOOD CANAL MOA ENVIRONMENTAL ASSESSMENT CONSULTATION MEETING
January 4, 2000
Minutes taken by Eileen Bergen

Attendees	Agency
Kimberly Kler	EFA NW
Martin Prehm	NUWC Keyport
Terry Black	NUWC Keyport
Eileen Bergen	EFA NW
Genny Rogers	Skokomish Tribe
David Herrera	Skokomish Tribe
Randy Harder	Point No Point Treaty Council
Robert Jusko	NUWC Keyport
Brad Sele	Jamestown S'Klallam Tribe

Commencement 10:00 A.M.

1. Introductions were made. The Navy distributed the proposed agenda.
2. Martin Prehm, Project Engineer, gave a project description of the military activities in the Dabob Bay area of the Puget Sound as follows.
   - Depth of Bay, 300-600 feet.
   - Many hydrophones and tracking arrays are permanently installed on the bottom of the Bay.
   - Tracking arrays are used to test sound signatures of ships, submarines and other military naval equipment.
   - 60% of testing done during summer and during daylight.
   - Approximately 200 tests done per year.
   - Tests can run sequentially or concurrently on testing days.
   - Silence is essential when checking equipment acoustic signatures.
   - Approximately one hour is needed per torpedo.
   - Torpedoes are not live (no warheads).
   - Biological activity is minimal (not a good fishing area) on the bottom in testing range.
   - Testing is halted during Marine mammal activity other than the presence of seals.
   - Navy would like to know more about tribal fishing, times, season etc. so scheduling conflicts can be minimized and co-operation can be maximized.
3. Fear of increased Naval activity into the main part of Hood Canal including encroachment into Tribal fishing areas was a concern brought up by some of the tribal representatives. The Navy explained that the reason for the Environmental Assessment is not because of new or extended military activity but because a new Operations Management Plan is being written to formalize ranging in the Hood Canal and Dabob Bay areas. The Navy also made it clear that the use of the Hood Canal area would not include placing acoustic monitoring devices such as those found in Dabob Bay.
4. Agreements were made to exchange information.
   - Navy would like to accommodate tribal fishing customs whenever feasible.
   - The main Navy contact person will be Martin Prehm.
   - Randy Harder will send shell and fin fish maps to the Navy contact.
   - Brad Sele and Randy Harder will work on sending the Navy a fishing activity matrix in approximately two weeks.
   - A follow-up meeting will be scheduled after the interested stakeholders have reviewed the exchanged information.
   - Tribes will be receiving the agency review copy of the Environmental Assessment to review and make comments.
   - Subsequent to the information exchange at the next meeting the following will be attempted:
     - Long term planning is often impossible for both Naval and fishing activities, however both sides will send preliminary and/or past schedules to minimize activity conflict.

- The Navy will send E-mail to all five tribe contact representatives when quickly scheduled tests are to be performed.

DABOB BAY AND HOOD CANAL MOA ENVIRONMENTAL ASSESSMENT
FOLLOW-UP CONSULTATION MEETING
February 8, 2000

Attendees	**Agency**
Kimberly Kler	EFA NW
Martin Prehm	NUWC Keyport
Terry Black	NUWC Keyport
David Herrera	Skokomish Tribe
Randy Hatch	Point No Point Treaty Council
Nancy Glazier	EFA NW

1. Introductions of attendees were made. Martin Prehm handed out the latest schedule for Dabob Bay and the Hood Canal.
2. David Herrera replied that having the hours of operation would help. Martin Prehm agreed to place a time frame of half or full day on the schedules he distributes.
3. David Herrera explained the Tribe's use of Dabob Bay and stated that weather patterns determine when the fishermen are out on the water. The uses are described below.
    - Dabob Bay is primarily used for crabbing. The crab pots are checked every other day, and are there for a 3-4 hour interval.
    - Crabbing will not go in more than 150 feet of water.
    - Shrimping will be in 200-300 feet of water.
    - There is some shellfish harvesting at Whitney Point.
    - The high volume time will be during the shrimping time frame, the first 10 days of May.
4. Martin Prehm suggested that the fishermen use marine band 12 or 16 to contact Dabob Bay Range Control when using Dabob Bay and the warning lights are on. He also stated that they are looking at posting the schedules on the web when Keyport's site is developed.
5. Randy Hatch asked what information the Tribes' will be sending to the Navy. The Navy and David Herrera responded that Randy Harder would be sending the annual regulations and any emergent regulations to the Navy.
6. Martin Prehm handed out three figures that correlated both the Navy and Tribe uses on the range.
7. David Herrera explained the fishing times in the area, as described below.
    - Shrimping - the tribes' will fish for about 10 days in the first 2 1/2 weeks (1-12 May).
    - They are not out shrimping during the state recreational shrimping days.
    - After the 3 - 4 June the Tribes will start shrimping again.
    - 3/4 of the shrimp fishery is estimated to be completed by June. The last 1/4 is in September, usually on the weekends. This information is identified in the annual regulations and add ons are the emergent regulations.
    - Crabbing - 75% are harvested in July, August and September. The Klallams' are the primary crabbers. They are looking at making the crabbing fishery more structured.
    - The salmon-fishing season is mid September to mid November. The salmon fisher is not as cost effective anymore. Chum salmon is the primary fishery.
8. Randy Hatch asked if there has been a history of the Navy boats running into tribal equipment (nets).
9. Martin Prehm replied that damage to tribal equipment has never been reported and the current civilian crews are extremely cautious.
10. David Herrera stated that any accidents have been strictly the responsibility of SUBASE Bangor.
11. Martin Prehm stated that if it is evident Keyport is responsible for any damages notify him and he will investigate and provide a response.
12. Kimberly Kler suggested that instead of another meeting she would draft an agreement to be used as mitigation in the Environmental Assessment and distribute via email for comment. The attendees agreed to this strategy.

Appendix C

Biological Assessment

BIOLOGICAL ASSESSMENT

for ongoing and future operations at

U.S. Navy Dabob Bay and Hood Canal Military Operating Areas

June 2001

U.S. Navy

BIOLOGICAL ASSESSMENT

for ongoing and future operations at

U.S. Navy Dabob Bay and Hood Canal Military Operating Areas

June 2001

- **Puget Sound Chinook Salmon**
- **Hood Canal Summer Chum Salmon**
- **Bull Trout, Coastal Puget Sound**
- **Steller Sea Lion**
- **Humpback Whale**
- **Bald Eagle**
- **Marbled Murrelet**
- **Northern Spotted Owl**
- **Leatherback Sea Turtle**

Prepared for:
Engineering Field Activity, Northwest
Naval Facilities Engineering Command
19917 - 7th Avenue Northeast
Poulsbo, Washington 98370

Prepared by:
EDAW, Inc.
Seattle, Washington
&
Polaris Applied Sciences
Kirkland, Washington

under contract to
MAKERS
Seattle, Washington

Table of Contents

FIGURES

TABLES

Acronyms and Abbreviations

BMA	Bottom Moored Array
CERCLA Act	Comprehensive Environmental Response, Compensation, and Liability
CFMETR	Canadian Forces Maritime and Experimental Test Ranges
CFR	Code of Federal Regulations
CITES	Convention on International Trade of Endangered Species
CSL	Cleanup Screening Levels
CWA	Clean Water Act
dbh	diameter at breast height
DBRC	Dabob Bay Range Complex
DMMP	Dredged Material Management Program
DO	dissolved oxygen
DOI	Department of the Interior
DPS	Distinct Population Segment
EA	Environmental Assessment
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FL	Fork Length
FR	Federal Register
GTV	General Test Vehicles
Hz	Hertz
IUCN	International Union on the Conservation of Nature and Natural Resources
kHz	kiloHertz
LC	Lethal Concentration
LF	low frequency
MEC	Median Effective Concentration
MK	Mark
MLC	Median Lethal Concentration
MOA	Military Operating Area
msl	mean sea level
NASWI	Naval Air Station Whidbey Island
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
nm	nautical mile
NOAA	National Oceanic and Atmospheric Administration
NOEC	No Observed Effect Concentration
NUWC	Naval Undersea Warfare Center
OMP	Operations and Management Plan
PHS	Priority Habitat and Species

Acronyms and Abbreviations (continued)

ppb	parts per billion
ppm	parts per million
PRST	Post Refit Sea Trial
PSEP	Puget Sound Estuary Program
PSK	Phase Shift Keyed
RMC	Royal Military College
ROC	Record of Communication
ROV	Remotely Operated Vehicle
SCEPS	Stored Chemical Energy Propulsion System
SF	square foot
SFSK	Spaced Frequency Shift Keyed
SL	screening level
SORD	Submerged Object Recovery Device
SQS	Sediment Quality Standards
SS	Submersible Ship
SSBN	Submersible Ship Ballistic Nuclear
SSN	Submersible Ship Nuclear
SUBASE	Submarine Base
TOC	total organic carbon
TOSS	Towed Submarine Simulator
TRB	Torpedo Retrieval Boat
UBC	University of British Columbia
*u*Pa	micro-Pascals
USFWS	United States Fish and Wildlife Service
UUV	Underwater Unmanned Vehicle
WDFW	Washington Department of Fish and Wildlife
WDOH	Washington Department of Health
WQC	Water Quality Criteria
YP	Yard Patrol
YTT	Yard Torpedo Tender

1.0 INTRODUCTION

Since the early 1950s the Navy has used Dabob Bay and a portion of the Hood Canal for underwater testing of undersea weapons systems, countermeasures, sonar systems, and related activities. These tests are supervised by the Naval Undersea Warfare Center (NUWC) located in Keyport, Washington. Potential biological effects are currently analyzed separately for each testing event within a National Environmental Policy Act (NEPA) Environmental Assessment (EA).

The purpose of this Biological Assessment is to determine if the Proposed Action will have an effect on a listed or proposed species or critical habitat and to ensure compliance with the Endangered Species Act (ESA). The following sections provide details on the project description, project area, species occurrence and habitat, and an analysis of potential effects to ESA protected species.

2.0 PROJECT DESCRIPTION

The Proposed Action is the implementation of the Operations and Management Plan (OMP) for the Dabob Bay project area. The OMP addresses a range of operations that encompass the existing Dabob Bay Military Operating Area (MOA), the two existing Hood Canal MOAs, and the connecting waters between them. This entire complex of ranges and connecting waters is hereafter referred to as the Dabob Bay Range Complex (DBRC). The DBRC is one of the Navy's premier sites for proofing, researching, and developing underwater weapons systems such as torpedoes, countermeasures, targets, ship systems, and Unmanned Underwater Vehicles (UUVs). Primary operations at the DBRC provide production acceptance (proofing) tests of underwater weapons (without warheads), research and development test support, and Fleet tactical evaluations involving aircraft, submarines, and surface ships. These tests and evaluations of underwater weapons from the first prototype and pre-production stages up through Fleet operations (cradle-to-grave monitoring) ensure reliability and availability of weapons and weapons components to the Fleet. The site also supports acoustic/magnetic measurement programs, including weapon/ship noise/magnetic signature recording, radiated sound investigations, and sonar harmonic evaluations. In the course of these operations, various combinations of aircraft, submarine, and surface ships are used as launch platforms. The intensity and frequency of operations and types of tests vary widely depending on the weapons testing programs. No new shore facilities are proposed for construction under this plan. All tests in the DBRC are conducted using torpedoes without warheads. Testing operations typically occur only on Mondays through Fridays, between the hours of 7 AM and 5 PM.

The OMP describes the underwater weapons systems test activities within the geographic boundaries of the DBRC. It focuses on managing the operations at the DBRC within current mission requirements. The OMP summarizes the various test characteristics including categories of operation and activities, the Navy's test range management program, and environmental issues associated with operations. The overall action of adopting the OMP is intended to ensure continued operation of the test ranges, while maximizing the existing and future potential use of the MOA resources by NUWC Division Keyport.

2.1 Testing Categories

Operations conducted on the range sites can be divided into four categories: research and experimental, proofing, fleet operations, and other operations. All vessels operating in the DBRC do so under applicable Coast Guard regulations. The following is a brief synopsis of the estimated level of activity associated with each of these categories within the DBRC for future operations. The estimated number of launches totals approximately 285 launches per year. (A "launch" includes underwater vehicle system test runs, as well as any vessel test runs.)

- Research and Experimental: Approximately 65 percent of annual testing is research and experimental in nature to evaluate the operational capabilities of test units. Primary systems involved with experimental tests include torpedoes, targets, UUVs, and stationary measurement platforms.
- Proofing: Approximately 15 percent of annual testing involves proofing or production acceptance testing, which ensures that the torpedo meets all service performance standards including quality, reliability, maintainability, and supportability. MK 48 torpedoes are the primary underwater vehicle systems involved in proofing tests.
- Fleet Operations: Approximately 15 percent of annual testing encompasses fleet operations, which involve evaluation programs and equipment tests for the Navy. Evaluation programs are utilized to assess the combat readiness of a vessel, system, and/or personnel. Tests in this category conducted at the MOA include submarine testing and surface ship testing. This testing is accomplished to certify that the vessels are ready for their operational missions.
- Other Testing Activities: Approximately 5 percent of annual testing is comprised of other tests, including range work and other miscellaneous testing efforts within the DBRC. Some of the testing is accomplished in support of the National Oceanic and Atmospheric Administration (NOAA) and other organizations.

Most of these operations require support operations prior to and upon completion of the test. Support operations include measuring the environmental conditions prior to testing and the retrieval/recovery of the test unit upon completion.

Table 2-1 shows the number of days the DBRC was used from 1997 through 1999, an average of 134 days per year. Historically, national security requirements have caused the number of days the range is used to vary significantly.

Table 2-1: Dabob Bay Range Complex Usage 1997-1999.

	Number of Days											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1999	9	20	16	8	3	4	8	9	16	17	4	7
1998	11	10	17	17	10	13	14	15	16	8	6	7
1997	12	9	12	6	11	11	15	13	13	14	9	13
Average	10.7	13	15	10.3	8	9.3	12.3	12.3	15	13	6.3	9

Source: U.S. Department of the Navy, 2000.

Most of these operations require support operations prior to and upon completion of the test. Support operations include measuring the

environmental conditions prior to testing and the retrieval/recovery of the test unit upon completion.

A typical test involving a torpedo operation would follow a series of steps prior to, during, and after the test. These typical steps are described below.

7. Prior to testing, the torpedo would be prepared in shop, containerized, and loaded onto a truck for transportation to the staging site (Submarine Base Bangor, Naval Air Station Whidbey Island [NASWI], etc.).
8. At the range, the unit is off-loaded from the truck, removed from the container, and loaded onto the firing craft (air, surface, or submarine). Sixty-five percent of all launches take place from the Yard Torpedo Tender (YTT) firing craft.
9. On range day, the torpedo would be prepared for firing and launched from the firing craft toward a Navy target.
10. During the course of the test, the torpedo transmits coded acoustic signals that are received by a series of underwater sonar arrays set on the floor of the bay. The tracking signals are transmitted to the range site tracking center at Zelatched Point for decoding and interpretation.
11. After the completion of the test, the spent torpedo either floats to the surface or sinks to the bottom of the bay. The test unit is recovered by surface craft, helicopter, or retrieved by underwater devices and vehicles.
12. Upon recovery or retrieval of the torpedo, it is off-loaded from the recovery craft, containerized, trucked back to the shop, unloaded, removed from the container, and prepared for next operation.

2.2 Testing Activity Summary

The activities involved in accomplishing the above-mentioned range operations are summarized in Tables 2-2 through 2-4. These tables identify the types of testing events by category and establish an estimated amount for each test as analyzed in the EA. The activities identified in Tables 2-2 through 2-5 are organized by the categories of Launching Systems, Types of Systems Tested, Test Propulsion Systems, and Systems Retrieval and Recovery, as described below. Multiple activities can be conducted during each test. Therefore, Tables 2-2 through 2-5 should not be read to indicate that the DBRC is constantly in active use. In fact, during 1997 the Dabob Bay MOA conducted testing on 138 days and the Hood Canal MOAs tested on approximately 60 days. These tests are often conducted concurrently. The projected ceiling on the annual range usage as identified in Tables 2-2 through 2-5 was used as the basis for impact analysis in this BA, as discussed in Chapter 3. These levels reflect a potential operational tempo that could occur, although actual use is expected to be somewhat less, similar to usage in recent years. In general, when any one test increases substantially, other test levels tend to decrease. Consequently, this document evaluates the highest probable level of impact and provides a level of analysis that is conservative in its protection of the environment.

2.2.1 Launching Systems

Launching systems are the various range support vessels, fleet vessels, or aircraft from which test units are launched (see Table 2-2). The majority of launches occur from range support vessels such as the YTT and special purpose barges.

Table 2-2: Launching Systems Used at the DBRC.

Activity	Platform/Systems Used	Estimated Range Usage
Launching Systems	Range Support Vessels • YTT firing craft • Special purpose barges	 Up to 180 launches Up to 75 launches
	Fleet Vessels	Up to 20 launches
	Aircraft	Up to 10 launches

Source: Department of the Navy 1999b

2.2.2 Types of Systems Tested

The weapons propulsion systems tested include thermal propulsion systems, such as the Otto Fuel II system and the Stored Chemical Energy Propulsion System (SCEPS). In addition, electric systems used during the testing include the electric vehicles used at the ranges, such as the General Test Vehicles (GTVs), UUVs, and targets. Other testing activities include submarine testing, mine sweeping, trawler exercises, acoustic and magnetic array testing, countermeasures, impact testing, and static testing in water. Table 2-3 summarizes the test units used at the DBRC, as well as a projected ceiling of range usage for each. Table 2-4 summarizes the related propulsion system.

Thermal Propulsion Systems

There are three types of thermal propulsion systems tested at DBRC: Otto Fuel II, SCEPS, and experimental thermal systems.

Otto Fuel II: Otto Fuel II propulsion systems power the majority of torpedoes tested at the Dabob Bay ranges. These propulsion systems are based on an external combustion engine that employs a monopropellant. Heat is transferred from the engine to the cooling water, which is then mixed with exhaust gases from the engine cylinders and discharged into the sea water via the hollow propeller drive shaft.

Stored Chemical Energy Propulsion System (SCEPS): SCEPS is a closed cycle, Rankine steam system. The major components of the system are the boiler (with steam generating tubes), turbine, condenser, and condensate pump. In the boiler, sufficient heat is absorbed to change the state of the water from liquid to steam. The high pressure steam is used to rotate a small turbine, connected via reduction gears to the drive shaft.. Both the reactants and products of the reaction are contained within the internal reaction chamber of the boiler and only heat escapes into the environment. The reactant, SF6, a component of the SCEPS system, is being phased out according to the Kyoto Protocols regarding the reduction of global warming gasses. The condensation and steam are sealed within their own separate system and do not contact the reactants or products of the reaction. Heat is transferred from the steam to the cool sea water passing over the torpedo via the condenser incorporated into the torpedo outer shell.

Table 2-3: Types of Underwater Vehicles Systems Tested.

Activity	Platform/Systems Used	OMP Estimated Range Usage[1]
Thermal Propulsion Systems	Otto Fuel II	Approximately 90 test
	Stored Chemical Energy Propulsion System (SCEPS) MK 50 Torpedo Defense Vehicle (TDV)	 Approximately 10 tests Approximately 10 tests
	Experimental Thermal Systems	Approximately 20 tests
Electric Systems	General Test Vehicles (GTV)	Approximately 60 tests
	Unmanned Underwater Vehicles (UUV)	Approximately 60 tests
	MK 30 Target	Approximately 20 tests
Other Testing Activities	Submarine Testing	Approximately 45 tests
	Mine Sweeping	Approximately 20 tests
	Non-Navy Testing (such as trawler exercises)	Approximately 5 tests
	Acoustic and Magnetic Array Testing	Approximately 10 tests
	Countermeasures	Approximately 50 tests
	Impact Testing	Approximately 10 impacts
	Static Testing in Water	Approximately 10 tests
Fleet Operations	Surface Ship Operations (excluding launches)	Approximately 10 tests
	Aircraft Operations	Approximately 10 tests
	Submarine Operations	Approximately 30 tests

Source: Department of the Navy 1999b
[1] *There may be multiple tests per launch*

Table 2-4: Test Propulsion Systems.

Test Unit	Propulsion System
Heavy Weight Torpedoes	Otto Fuel II
Light Weight Torpedoes	Otto Fuel II SCEPS
Experimental Thermal Systems/Exotics	Possible variation of SCEPS, rocket fuels, JP-5, or other fuels. Others unknown at this time.
General Test Vehicle	Silver/nickel battery electric engine
Unmanned Underwater Vehicle	Silver/nickel battery electric engine
Submarine Testing	Nuclear propulsion systems
Mine Sweeping	Gas turbine engines
Non-Navy Testing	Gas turbine or diesel
Acoustic and Magnetic Array Testing	N/A
Counter Measures	N/A
Impact Testing	Otto Fuel II SCEPS
Static Testing	Otto Fuel II

Source: Department of the Navy 1999b.

Experimental Thermal Systems: These experimental systems use both open and closed systems; some will have byproducts and/or acoustics while some will not. The precise components of these systems are under development and are undetermined at this time. An estimated 20 runs per year would be conducted on the DBRC. Possible fuel systems include JP-5, variations of SCEPS fuel, and rocket fuel.

Electric Systems

A number of different test units are powered by electric motor using silver-zinc batteries, including unmanned underwater vehicles (UUV), general test vehicles (GTVs), and MK-30 targets. The MK-30s are mobile targets used in Fleet training. The UUVs and GTVs are unmanned submersibles which can undertake a number of testing missions.

Other Testing Activities

This is an obviously broad category of tests which includes most activities other than testing torpedoes, generally using the acoustic profiling capabilities of Dabob Bay. Submarines are tested for various operational characteristics, and some mine sweeping tests are run. Non-Navy tests of tracking instrumentation, particularly from NOAA, are sometimes run. A few operations involving the installation of acoustic and magnetic equipment for calibration and/or testing are run each year.

A number of tests involving electronic counter measures are run each year. These are typically devices which distract a sonar, including a torpedo, from its target. At limited times countermeasures or simulated targets generating electromagnetic fields are tested in the Dabob Bay range. These tests consist of a ship or MK 30 torpedo towing a wire while traveling along the long axis of the range. The wire emits an electromagnetic field with an intensity of about $4\pi10^{-6}$ Gausses/m, where m = perpendicular distance from the source in meters. The electromagnetic frequencies are less than 3,000 Hz. Testing can be near the surface or at depth, depending on the purpose of the test. Electromagnetic tests are conducted only about 10 times per year.

Impact tests are run fewer than 10 times a year. These involve a test where the torpedo is actually programmed to strike a target. A situation can then arise wherein the torpedo actually ruptures upon striking the target, with the potential to release pollutants in the form of fuel into the water column. While this potential is low, it nonetheless exists.

A small number of static tests are run in Dabob Bay each year, involving a torpedo attached to a stationary platform with its propeller removed. For those units powered by Otto II Fuel, exhaust gases are then released into a concentrated area rather than being distributed over the length of the run.

Fleet Operations

These are tests involving general fleet operations or NUWC Division Keyport operations. Fleet operations include surface ship operations such as frigates, cruisers, and destroyers; aircraft operations involving SH-60 MH-53, and P-3 aircraft (or equivalents); and submarine operations including SSN, SSBN, and SS submarines. Operations by Keyport at the DBRC in support of these tests typically encompass the support craft used to support test operations at the range and buoy use for vessel moorage; limited loading and storage facilities; operation of acoustic acquisition equipment used for measurement and recording of ambient noise, radiated self-noise, active noise, and sonar noise; operation of range tracking equipment such as underwater sonar and above water global positioning system (GPS); operation of targets, both mobile and stationary; and occasional use of privately contracted helicopters. A Towed Submarine Simulator (TOSS) trailed behind a vessel simulates the acoustic image of a submarine for test purposes and is used approximately 10 times per year.

2.2.3 Systems Retrieval and Recovery

Systems recovery and retrieval occurs after the completion of a test. Retrieval is the collection of the test vehicle from the surface of the water by vessel or helicopter. Recovery is the collection of the test vehicle when it is lying on the bottom of the bay or has become partially buried in the bottom sediments and requires some digging (see Table 2-5). Approximately 95 percent of the underwater vehicles tested contain buoyancy systems that allow the units to float on the surface of the water. Retrieval operations can be performed by surface craft, such as the TRB, or helicopters. Approximately 5 percent of the units sink to the bottom; these are retrieved using a Submerged Object Recovery Device (SORD) or a Remotely Operated Vehicle (ROV).

Table 2-5: System Retrieval and Recovery.

Activity	Platform/Systems Used	OMP Estimated Range Usage[1]
Buoyancy Systems	Positive Buoyancy	Approximately 155 test
	Active Buoyancy	Approximately 115 test
Negatively Buoyant Systems	Unburied Units	Approximately 15 test
	Buried Units	A minority of those units that go to the bottom bury themselves and have to be recovered.

Source: Department of the Navy 1999b

About 15 tests per year must be recovered from the bottom, some of these requiring minor excavation. Rarely (approximately 1 in every 5 years) a test vehicle has driven itself into the bottom sediments for its entire length, at the extreme, up to 28 feet (8.5 m) deep. Recovery of these vehicles requires excavating a hole that is approximately 30 feet (9.2 m) in diameter and 28 feet (8.5 m) deep or deeper.

3.0 DESCRIPTION OF PROJECT AREA

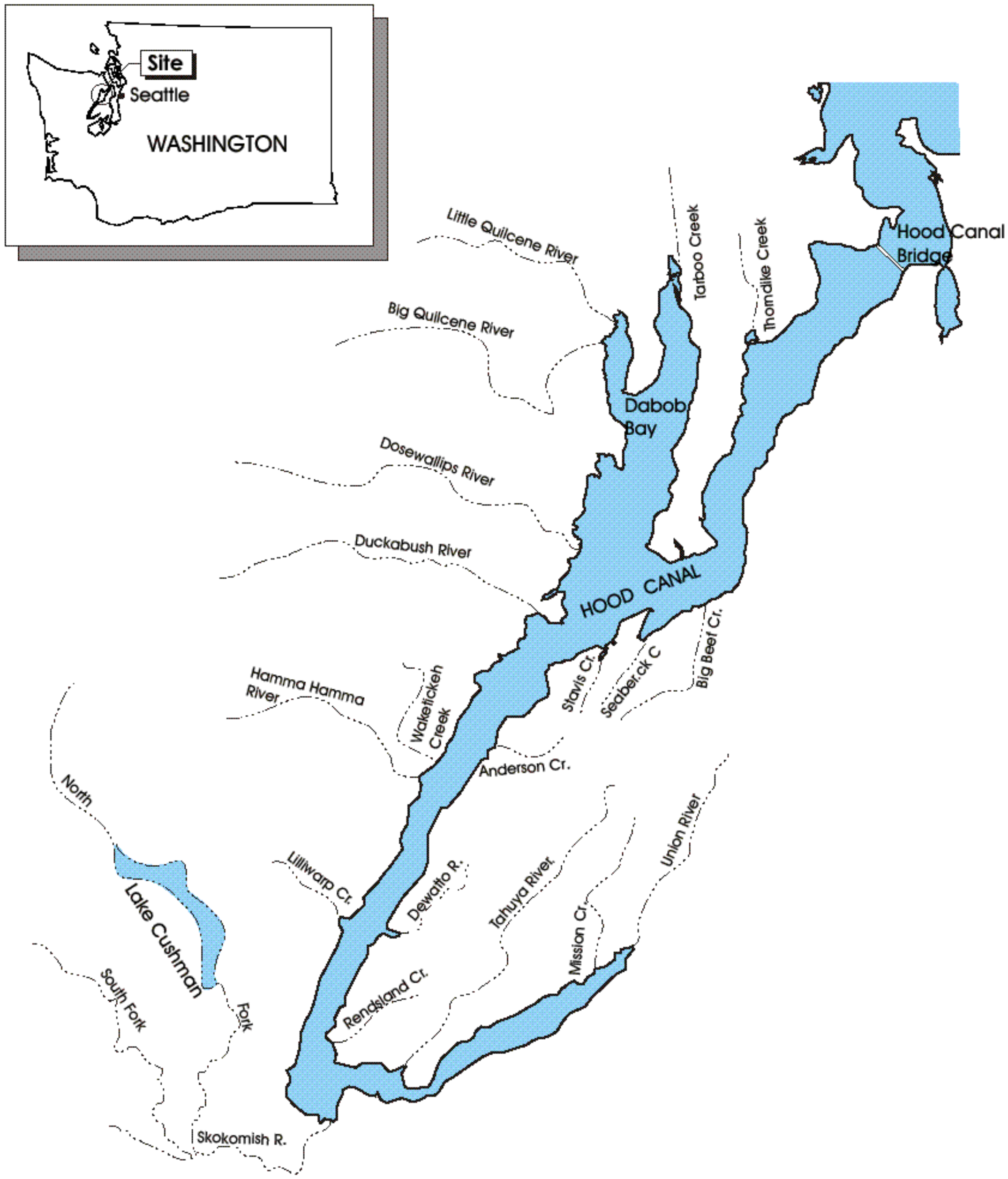
The Dabob Bay MOA is located on Dabob Bay in Jefferson and Kitsap counties, in western Washington. Dabob Bay is a remote inlet extending from the western side of Hood Canal into the Olympic Peninsula (Figure 3-1). The range area is 25 miles (40 km) west of Seattle, and 10 miles (16 km) west of NUWC Division Keyport. As mentioned, range facilities within the DBRC include the Dabob Bay MOA and the two Hood Canal MOAs (see Figure 3-2). The Dabob Bay MOA is located entirely within Dabob Bay. The Hood Canal MOAs are located in the Hood Canal east of Dabob Bay, separated from Dabob Bay by the Toandos Peninsula. The mouth of Dabob Bay, and the MOA, is separated from the southernmost Hood Canal MOA by 3.75 miles (6 km). The general area is rural with a few scattered houses and cabins near the shoreline. Second-growth mixed conifer forest dominates the vegetation of the shoreline, with old-growth forest west of Quilcene Bay on federal land.

3.1 Dabob Bay Military Operating Area

The Dabob Bay MOA is bounded on the northwest by Bolton Peninsula, Quilcene Bay on the west, on the east by Toandos Peninsula, and the Hood Canal to the south (see Figure 3-3). Within Dabob Bay, the marine-based operating area is approximately 7.25 nautical miles (nm) by 1.25 nm (13.4 by 2.3 km). The Dabob Bay MOA encompasses all the waters of Dabob Bay, except for the navigable waters along the western shoreline. In Dabob Bay, the MOA is defined as all waters beginning at latitude 47 deg.39'27", longitude 122 deg.52'22"; thence northeasterly to latitude 47 deg. 40'19" longitude 122 deg. 50'10"; thence northeasterly to a point on the mean high water line at Takutsko Point; thence northerly along the mean high water line to latitude 47 deg. 48'00"; thence west on latitude 47 deg.48'00" to the mean high water line on the Bolton Peninsula; thence southwesterly along the mean high water line of the Bolton Peninsula to a point on longitude 122 deg. 51'06"; thence south on longitude 122 deg. 51'06" to the mean high water line at Whitney Point; thence along the mean water line to a point on longitude 122 deg. 51'15"; thence southwesterly to the point of beginning (33CFR334.1190).

The western MOA boundary is about 1 mile (1.6 km) east of Dosewallips State Park on the Olympic Peninsula. Geographically, the center of the range is located at 47º 43' 34" North, 122º 50' 28" West. Average depth at the site is 375 feet (114 m) with a maximum depth of 600 feet (183 m). Site operations are controlled and recorded at the Range Control Center located at Zelatched Point on the Toandos Peninsula.

In addition to the actual water-based range, the Dabob Bay MOA encompasses several land-based facilities. The Zelatched Point area occupies 28 acres (11.3 ha) of land overlooking Dabob Bay (see Figure 3-4).



Source: NOAA, US NAVY

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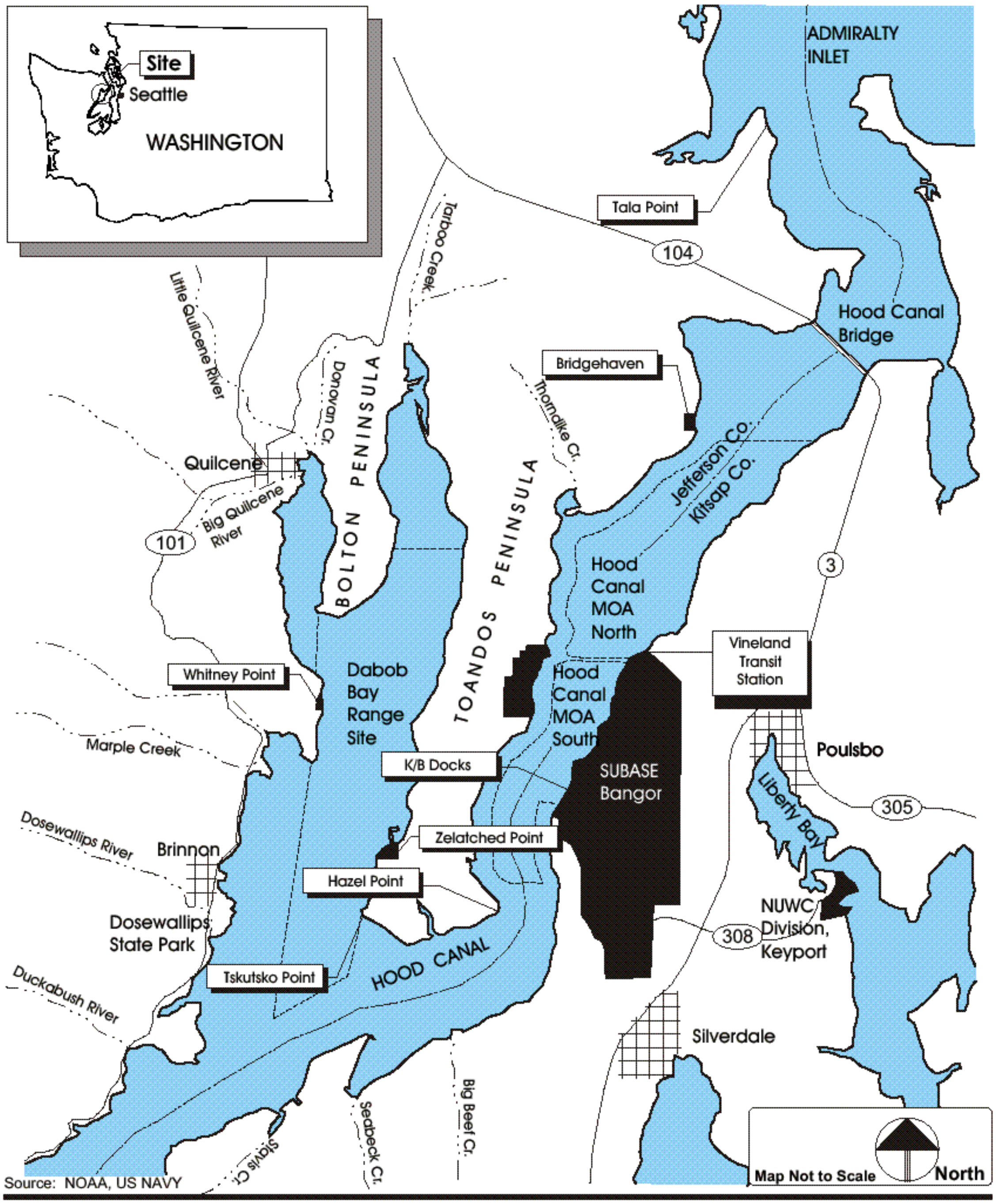
Major Streams and Rivers in Hood Canal vicinity

Figure 3-1



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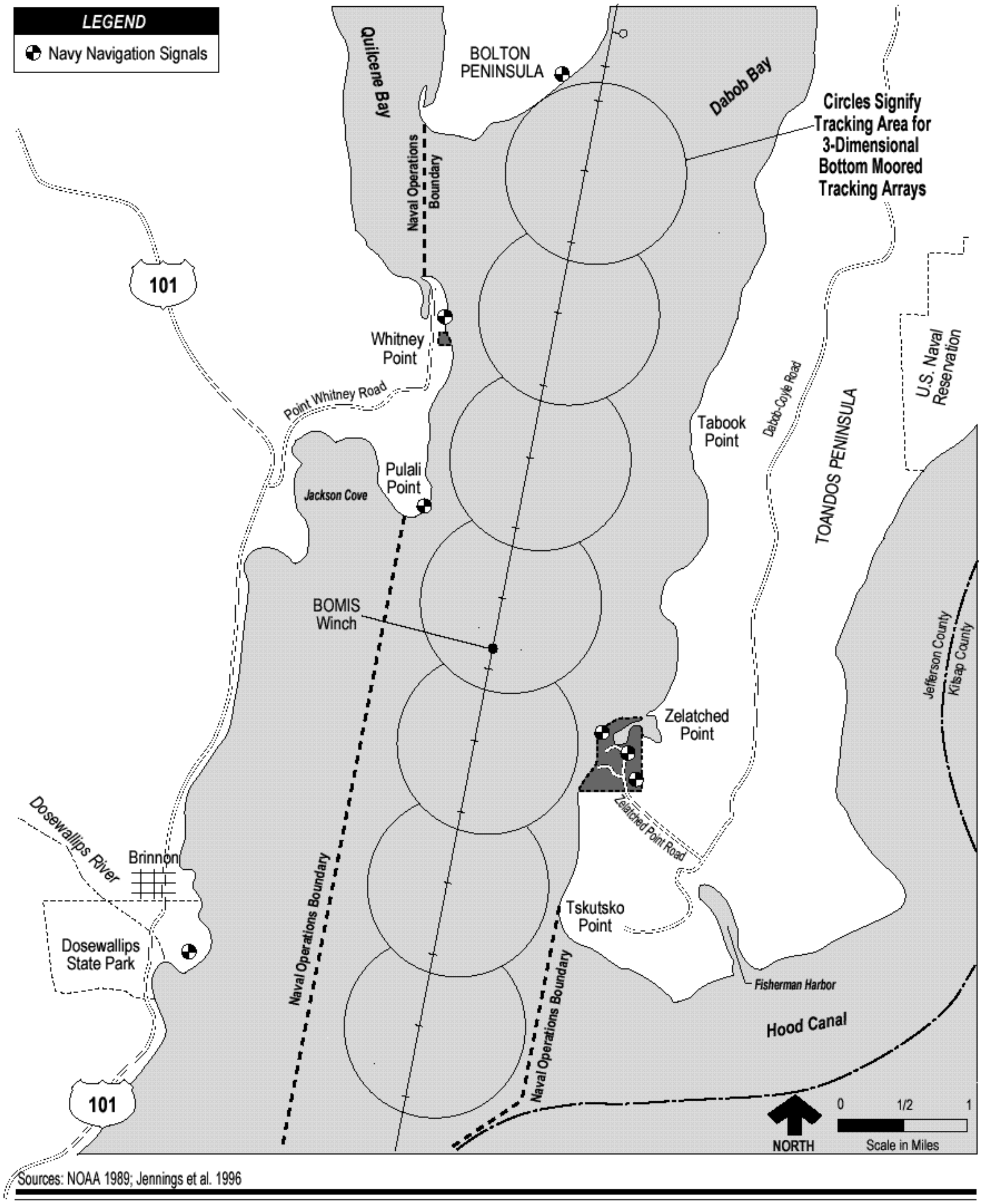
NUWC Division, Keyport

Military Facilities in Vicinity of Dabob Bay/Hood Canal MOA's Showing Major Streams and Rivers

Figure 3-2



Sources: NOAA 1989; Jennings et al. 1996

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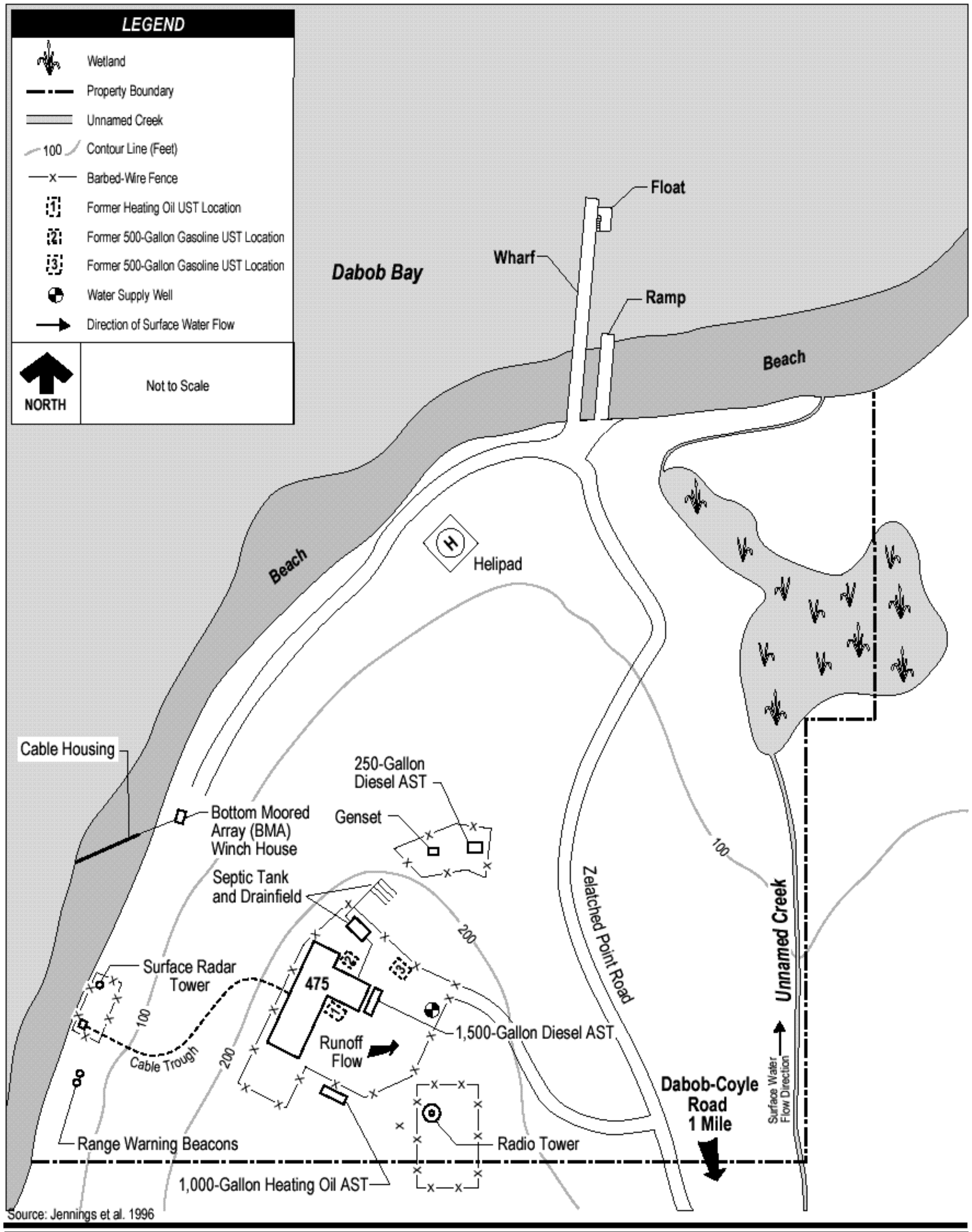
Dabob Bay MOA

Figure 3-3



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Zelatched Point Site Map

Figure 3-4

Major site facilities include a 2,500 square foot (SF) (232 m^2) computer building and a 150-foot (46 m) radio tower located on a bluff 200 feet (61 m) above mean sea level (msl). Beach facilities include a Navy pier, a boat ramp, a helipad, a surface radar tower, warning beacons, and a winch house. A portion of the property is located in an estuarine wetland southeast of the pier. The wetland is fed by an unnamed, intermittent stream that runs north across the Navy property.

The pier at Zelatched Point has been historically used for float planes and range craft berthing during operations. It is 300 feet (91 m) in length and can accommodate range craft. There is no power supply or pump-out capability at the Zelatched pier, limiting the capability of the pier to temporary mooring purposes only. Typical range craft used during operations are summarized in Table 3-1.

Table 3-1: Dimensions and Use of Typical Range Craft.

Type of Craft	Weight	Length/Beam/Draft	Use
Yard Torpedo Tender (YTT)	1,200 tons	186’/40’/10’6”	Launching/recovery of underwater ordnance and range maintenance support.
Torpedo Retrieval Boat (TRB)	41.2 tons	72.9’/17’/6’6”	Torpedo and mobile target retrieval and personnel transport.
Yard Patrol (YP)	176 tons	108’/24’/6’	Sound/target boat and personnel transport.
Work Boats	3 tons max	24’/8’/34” max	Range maintenance and special projects support.

Source: NUWC Division Keyport, 1999.

Motorized and non-motorized barges and miscellaneous small boats are also used for operations. There are seven underwater tracking arrays spaced approximately 2,000 yards (1,828 m) center to center along a datum line that is oriented north/south through the center of Dabob Bay (Figure 3-2). These arrays receive a special signal from underwater hydrophones located on vehicles the range wishes to track in three dimensions. One permanently deployed bottom moored array (BMA) is used to acquire and record underwater radiated noise at the site. The BMA can be vertically positioned to any depth between 100 and 425 feet (30 to 130 m). The BMA, along with other noise-monitoring devices, is critical to provide a full spectrum capability for the measurement and analysis of radiated noise, structure borne noise, self-noise, and ambient noise in support of range operations. There is a large amount of cabling and sensitive equipment permanently moored on the bottom of Dabob Bay within the MOA, used to measure acoustic/magnetic signals or act as communications and warning systems.

Navy-maintained yellow, white, and red warning lights are located at Sylopash Point, Pulali Point, Whitney Point, Zelatched Point, and the southeast edge of Bolton Peninsula, all within site of the Dabob Bay MOA.

The purpose of the lights is to warn non-military craft of the status of operations in the MOA. Non-military craft may be required to shut off their engines during operations to eliminate acoustical interference during noise-sensitive testing. During operations, Naval Guard boats may require non-military craft in the MOA to stop engines for the duration of operations. Marine radio channels 12 or 16 are also monitored during operations in Dabob Bay by range control.

3.2 The Hood Canal Military Operating Areas

The Hood Canal MOAs are located 5 miles (8 km) west of Keyport, just north and west of the Naval Submarine Base (SUBASE) Bangor. The Hood Canal MOA includes those waters between latitude 47 deg.46’00” and latitude 47 deg.42’00”, exclusive of navigation lanes one-fourth nm (0.46 km) wide along the west shore and along the east shore south from the town of Bangor (latitude 47 deg.43’28”) (33CFR334.1190). Operating area dimensions are approximately 4 nm by 1 nm (7.4 by 1.8 km), and the center is located at 47º 46’ 00 North, 122º 44’ 00 West. The area is divided into the Hood Canal MOA 1 and Hood Canal MOA 2. The Hood Canal MOA 1 runs approximately from Bridgehaven (47º 50’ 00 North) on the Toandos Peninsula across to the eastern shore of the canal, south to an area approximately level with the Vinland Transit Station (46º 00’00 North). The Hood Canal MOA 2 runs from the southern end of MOA 1, farther south to an area just north of Hazel Point (42º 00 00 North). The water depth averages 200 feet (61 m).

The Hood Canal MOAs are used in testing sensor accuracy, special torpedo launches, and for simple tests not requiring tracking. Torpedo launching in the Hood Canal MOAs is to test start-up, launch, and recovery capability only, not for actual torpedo deployment. Torpedoes that are tested in Hood Canal generally have electric propulsion systems rather than thermal propulsion systems. The duration of these torpedo tests is generally from 30 seconds to one minute. There are no permanent facilities or tracking equipment in place in this range. To date, portable range equipment for tests has been temporarily deployed in the range for acoustic tracking, when required.

3.3 Connecting Waters

The connecting waters refer to that portion of the Hood Canal that connects the Dabob Bay MOA with the Hood Canal MOAs, along the southern edge of the Toandos Peninsula. No permanent Navy equipment is present in this area. The area is currently used only for transiting vehicles in the DBRC. In the future, it could be used as a transit area for test runs that start in the Hood Canal MOAs and end in Dabob Bay MOA, or vice-versa. Water depth in the connecting waters area is typically greater than 300 feet (91 m). The shortest distance between the Dabob Bay MOA and the Hood Canal MOA is approximately 3.75 nm (6.9 km).

4.0 LIST OF SPECIES

A list of threatened and endangered species that may occur in the project area was requested from NMFS and the U.S. Fish and Wildlife Service (USFWS). Table 4-1 indicates the species that are listed under the ESA or are candidates for listing under the jurisdiction of NMFS and USFWS.

Table 4-1: Species Listed under the Endangered Species Act that May Occur in the Dabob Bay Project Area.

Species	ESA Status	Responsible Agency
Hood Canal summer chum salmon (*Onchorynchus keta*)	Threatened	NMFS
Puget Sound chinook salmon (*O. tshawytscha*)	Threatened	NMFS
Steller sea lion (*Eumetopias jubatus*)	Threatened	NMFS
Humpback whale (*Megaptera novaeangliae*)	Endangered	NMFS
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered	NMFS
Bull trout, coastal Puget Sound (*Salvelinus confluentus*)	Threatened	USFWS
Bald eagle (*Haliaeetus leucophalus*)	Threatened	USFWS
Marbled murrelet (*Brachyramphus marmoratus*)	Threatened	USFWS
Northern spotted owl (*Strix occidentalis caurina*)	Threatened	USFWS

Source: ROC, Landino, 1999; ROC, Jackson, 1999

4.1 Species under jurisdiction of the National Marine Fisheries Service

The Washington State Habitat Branch of the NMFS provided a list of fish species under NMFS jurisdiction that are listed or are candidates for listing under the Endangered Species Act and are present in the marine waters of the Dabob Bay and Hood Canal MOAs (ROC, Kler, 1999a). This list was provided in a letter dated August 10, 1999 from Mr. Steven Landino of the NMFS Washington State Habitat Branch to Mr. Gerald Erickson of Polaris Applied Sciences (ROC, Landino, 1999). Copies of these letters are contained in Appendix A.

The two fish species under the jurisdiction of NMFS are the Hood Canal summer-run chum salmon (*Onchorynchus keta*) and the Puget Sound chinook salmon (*O. tshawytscha*); other species under NMFS jurisdiction include the Steller sea lion (*Eumetopias jubatus*), humpback whale (*Megaptera novaeangliae*), and leather back sea turtle (*Dermochelys coriacea*).

4.1.1 Hood Canal Summer-Run Chum Salmon

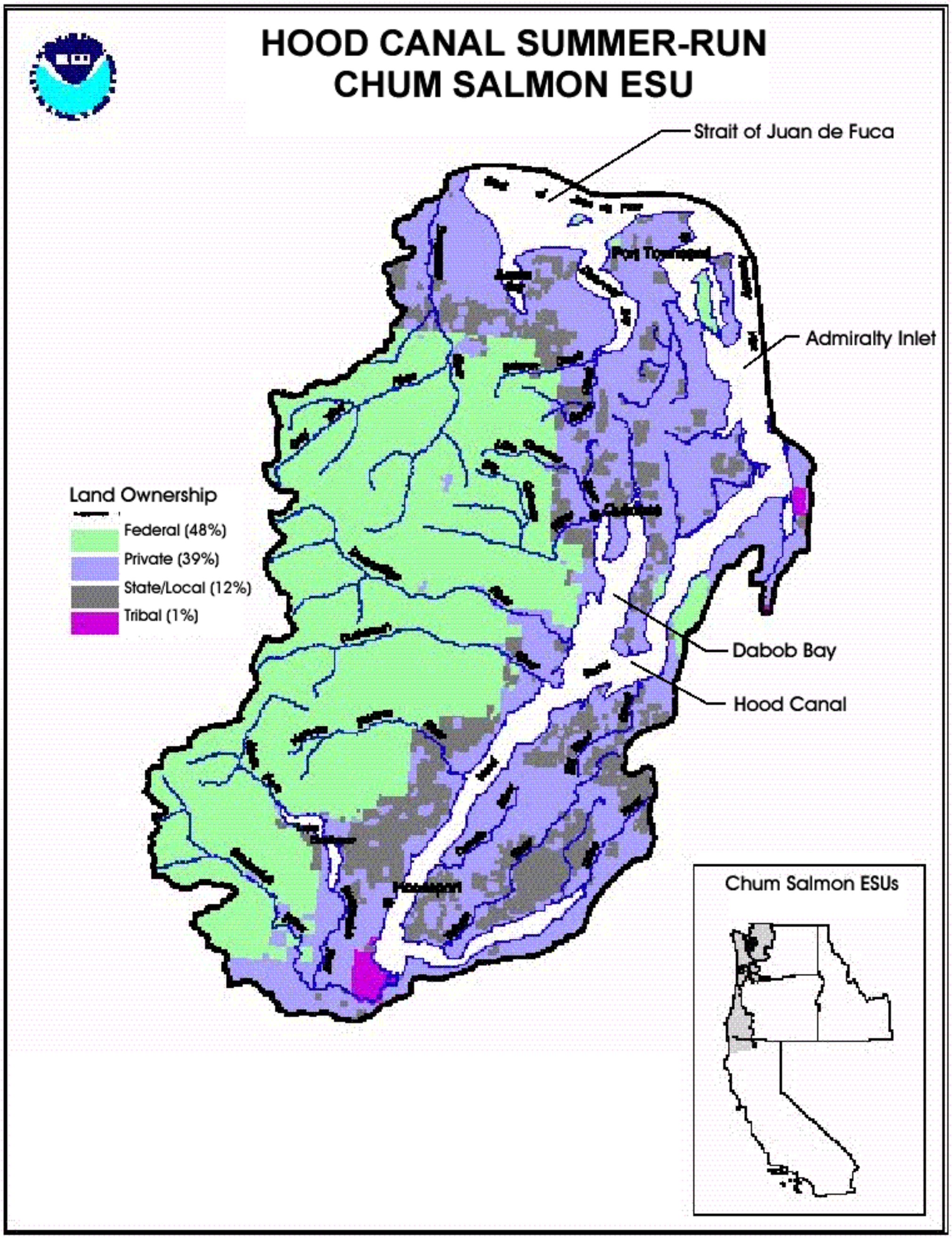
The Hood Canal Evolutionarily Significant Unit (ESU) of summer-run chum salmon was listed as threatened under the ESA in March of 1999, effective May 24, 1999, along with the Columbia River chum salmon ESU (64 FR 14508; March 25, 1999). The Hood Canal ESU is defined as including all summer-run chum salmon stocks in rivers flowing into Hood Canal (including Dabob Bay), in drainages of the Olympic Peninsula along Admiralty Inlet, in rivers flowing into Discovery and Sequim bays, and in the Dungeness River (Figure 4-1; NMFS 1999a). Within this ESU, only naturally spawned populations of chum salmon were actually listed, and not hatchery stocks. Critical habitat for Hood Canal summer-run chum salmon was proposed for designation in March 1998 and essentially consists of all freshwater and estuarine habitats currently utilized by these fish (63 FR 11774; March 10, 1998). As of January 2000, no final designation of critical habitat had been made.

4.1.2 Puget Sound Chinook Salmon

The Puget Sound ESU of chinook salmon was listed as threatened under the ESA in March 1999 effective May 24, along with two other chinook salmon ESUs, and one ESU listed as endangered (63 FR 14308; March 24, 1999). The Puget Sound ESU is defined as all runs of chinook salmon flowing into Puget Sound and the Strait of Juan de Fuca from the Canadian border to the Elwha River on the Olympic Peninsula (Figure 4-2; NMFS 1999b). Only naturally spawned populations and selected hatchery stocks of Puget Sound chinook salmon were actually listed. Naturally spawned descendants of spring-run chinook salmon hatchery fish from the Quilcene National Fish Hatchery, which were derived from Sol Duc River (on the western Olympic Peninsula) and Quilcene River broodstock, were specifically excluded from this ESU and listing. Critical habitat for Puget Sound chinook salmon was proposed for designation in March 1998 and essentially consists of all freshwater and estuarine habitats currently utilized by these fish (63 FR 11482; March 9, 1998). Marine habitats in Puget Sound utilized by chinook salmon was also included in this proposed designation. As of January 2000, no final designation of critical habitat had been made.

4.1.3 Steller Sea Lion

Steller sea lions are listed as threatened in most of their range, including Puget Sound. A small population is listed as endangered by NMFS (60 FR 51968). The listing of Steller sea lion as threatened followed dramatic declines in the northern population from about 110,000 individuals in 1978 to a current population of about 40,000 individuals. The depletion of groundfish stocks in Steller seal lion habitat is suspected to be the primary cause for the decline. No haulout or breeding sites have been identified by NMFS in the Dabob Bay project area.



Source: National Marine Fisheries Service

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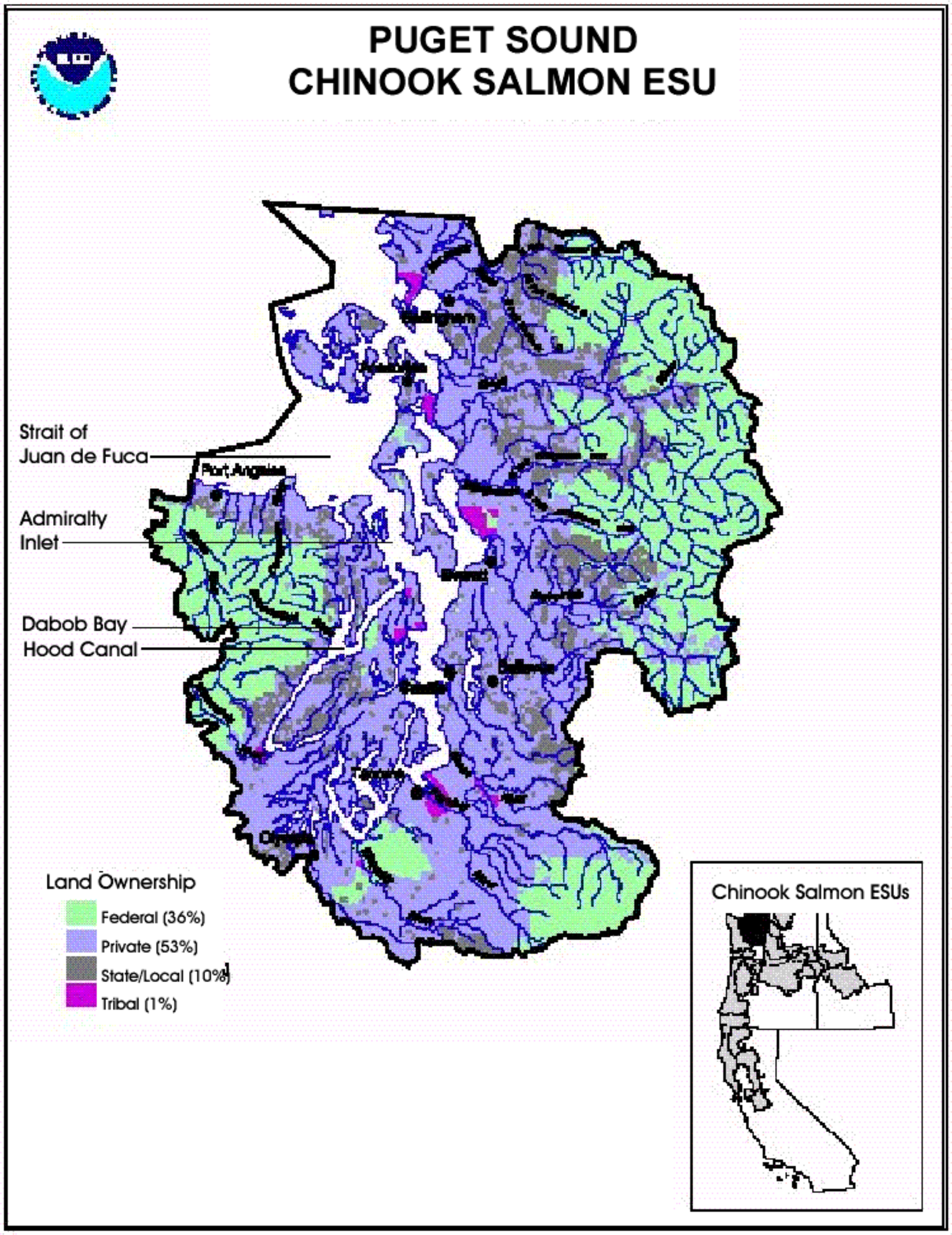
Hood Canal Summer-Run Chum Salmon ESU Map

Figure 4-1



Source: National Marine Fisheries Service

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Puget Sound Chinook Salmon ESU Map

Figure 4-2

4.1.4 Humpback Whale

Humpback whales have suffered severe population declines throughout their range from hunting during the late 1800s and early 1900s. Prior to commercial whaling, the worldwide population is thought to have been greater than 125,000. About 7,000 humpbacks occur in the waters of the United States. Humpback whales are listed as an endangered species under the ESA and are under the jurisdiction of NMFS. The humpback whale also has protected status under the Convention on International Trade in Endangered Species (CITES) and is listed as endangered in the International Union for Conservation of Nature and Natural Resources (IUCN) report.

4.1.5 Leatherback Sea Turtle

Leatherback sea turtles are listed as endangered under the ESA and have protection under CITES. The species breeds in tropical areas and only occasionally visits the North Pacific. Critical habitat for the leatherback sea turtle has been designated off St. Croix of the Virgin Islands.

4.2 Species under jurisdiction of the United States Fish and Wildlife Service

The Western Washington Office of the USFWS provided a list of species under USFWS jurisdiction listed or proposed for listing under the ESA that may occur in the vicinity of the Dabob Bay and Hood Canal MOAs (ROC, Kler, 1999b). This list of species was provided in a letter dated September 16, 1999 from Mr. Gerry Jackson of the USFWS Western Washington Office (ROC, Jackson, 1999). Copies of these letters are contained in Appendix A.

One fish species is listed in the letter from the USFWS - the coastal/Puget Sound bull trout (*Salvelinus confluentus*), which is listed as threatened under the ESA. Wildlife listed in the letter from USFWS include: (1) the bald eagle (*Haliaeetus leucophalus*), (2) the northern spotted owl (*Strix occidentalis caurina*), and (3) the marbled murrelet (*Brachyramphus marmoratus)*.

4.2.1 Coastal / Puget Sound Bull Trout

The coastal/Puget Sound bull trout Distinct Population Segment (DPS) was listed as threatened under the ESA by the USFWS in November 1999, along with one other DPSs of bull trout (64 FR 58910; November 1, 1999). The coastal/Puget Sound bull trout population segment geographically includes all Pacific Ocean drainages in Washington State including Puget Sound (WDFW 1998). It was found that designation of critical habitat for coastal/Puget Sound bull trout was non-determinable at that time, with a final decision to be made in two years.

4.2.2 Bald Eagle

The bald eagle was federally listed as endangered in all of the conterminous United States except Minnesota, Wisconsin, Michigan, Oregon, and Washington where it was classified as threatened. This was in response to a drastic decline bald eagle productivity between about 1947 and 1970. Research indicated that the production and use of organochlorine pesticides were causing an excessive thinning of egg shells and the resulting productivity declines. A Pacific Bald Eagle Recovery Plan was published by USFWS in 1986. Eagle populations have since recovered and the USFWS has recently proposed that the bald eagle be delisted (50 CFR 17, Federal Register, July 6, 1999, V4, No. 128).

4.2.3 Marbled Murrelet

The marbled murrelet was listed as a threatened species by USFWS in 1992 due to a high rate of nesting habitat loss and fragmentation, as well as mortality associated with net fisheries and oil spills. The primary factor in murrelet habitat loss and fragmentation was commercial logging throughout its range. In addition, the President's Northwest Forest Plan (USDA and USDOI 1994) provides guidelines for the management of marbled murrelet habitat on federal lands. Marbled murrelets nest in old-growth forest and feed in coastal and inland waters, including Puget Sound.

4.2.4 Northern Spotted Owl

The northern spotted owl was listed as a threatened species by USFWS in July 1990 after an initial refusal to list the species and a subsequent court challenge. Northern spotted owl populations have severely declined in the past 25 years because of their close association with old-growth forest and the consequences of large-scale habitat removal from commercial logging. The Department of the Interior (DOI) has prepared a recovery plan for the species, and guidelines for management of the northern spotted owl are included in the President's Northwest Forest Plan.

5.0 DESCRIPTION OF THE SPECIES AND HABITAT

5.1 Fisheries

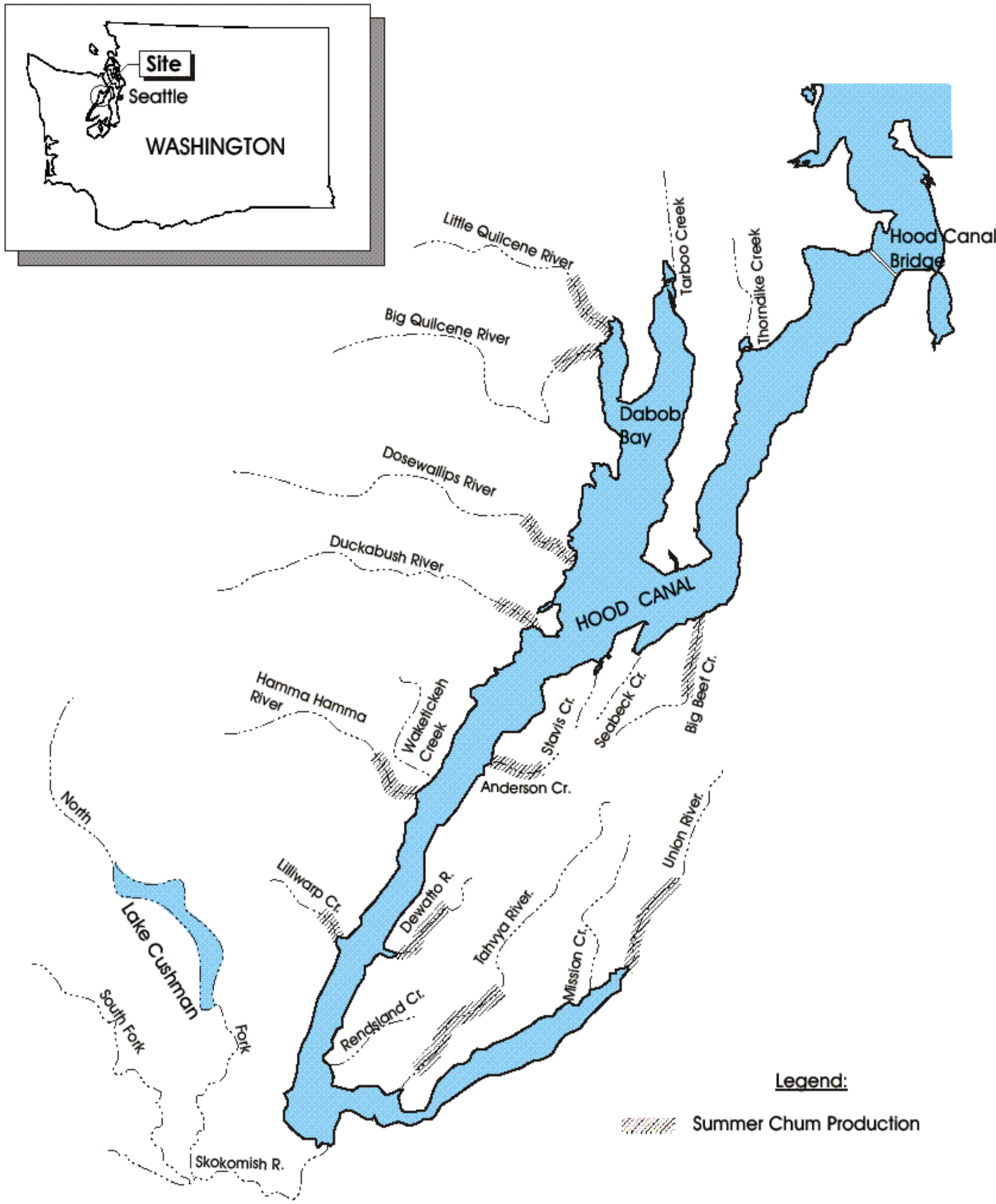
5.1.1 Hood Canal Summer-Run Chum Salmon

Chum salmon are found on both sides of the North Pacific Ocean, from Japan and Korea north to the Arctic Ocean coastline of Russia, and from central California north to the Arctic Ocean coastline of Alaska, Yukon, and the Northwest Territories (Salo 1991). Chum salmon are anadromous fish, spawning in freshwater streams and rivers and migrating directly to sea following emergence from the gravel redds where their eggs were laid. After a brief residence time in estuaries near their natal streams, chum salmon spend two to five years in the North Pacific Ocean before returning to spawn in their home river or stream, after which the fish die.

Chum salmon have historically utilized almost all accessible rivers and streams entering Hood Canal and Dabob Bay (Williams et al. 1975). There are fall-run chum salmon stocks in almost all of these rivers, with a smaller number of rivers and streams having summer-run stocks as well. Fall-run chum salmon in Hood Canal are characterized as those fish that enter their home rivers starting in October and November and spawn from November through January. Summer-run chum salmon are those fish that enter their native rivers starting in August and September and spawn from mid-September through October.

Major rivers historically supporting summer-run chum stocks in Hood Canal include the Big and Little Quilcene, the Dosewallips, Duckabush, Hamma Hamma, Skokomish, Tahuya, Dewatto, and Union rivers (Figure 5-1). Smaller streams historically supporting summer-run chum salmon include Coulter, Rocky, Big Beef, Anderson, and John creeks. Recent analysis indicates that summer-run chum stocks have been extirpated in the Dewatto and Tahuya rivers and in Big Beef and Anderson creeks (Tynan 1997). In addition, the Skokomish River is not considered to have a viable run of summer-run chum, with only incidental fish reported. Tynan (1997) does not list summer runs as being present in Coulter or Rocky creeks, but does list a summer run in the Lilliwaup River.

Tynan (1997) assessed the population status of summer-run chum salmon stocks in Hood Canal as “rebuilding” in the Big Quilcene and Dosewallips rivers, “stable” in the Union River, “low/stable” in the Hamma Hamma and Duckabush rivers, “very low/stable” in the Lilliwaup River “low” in the Little Quilcene River, “functionally extirpated” in the Tahuya River, and “extirpated” in the Dewatto River, and in Big Beef and Anderson creeks (Table 5-1).



Source: TYNAN 1997

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Summer Chum Production Streams in the Hood Canal Basin

Figure 5-1

Table 5-1: Summer Chum Production Streams in Hood Canal and their Population.

Drainage	1990-94 average escapement *	1995-96 average escapement *	Population status (including 1996)
Big Beef Creek	0	0	Extirpated
Big Quilcene River	330	6,500	Rebuilding
Little Quilcene River	5	160	Low
Anderson Creek	0	0	Extirpated
Hamma Hamma River (includes John Creek)	156	690	Low / stable
Duckabush River	276	1,857	Low / stable
Dosewallips River	285	5,900	Rebuilding
Lilliwaup River	76	90	Very low / stable
Dewatto River	11	0	Extirpated
Tahuya River	7	6	Functionally extirpated
Union River	340	700	Stable

Source: Tynan 1997
** Escapement estimates from the Washington Department of Fish and Wildlife (WDFW) chum, pink and sockeye stock assessment unit.*

Returning adult summer-run chum salmon enter Hood Canal from early August through the end of September, with the central 80% of the run reaching south Hood Canal from August 27 through September 22 (WDFW and WWTIT 1994; Lampsakis 1994 as cited in Tynan 1997). In-migrating adult salmon in Puget Sound are usually found in the top 30 feet (9.1 m) of the water column (WDFW 1999b).

Adult summer chum have been observed to enter Quilcene Bay at the head of Dabob Bay from the third week in August through the first week in October, with the central 80% of the run entering from August 30 through September 28 (Lampsakis 1994 as cited in Tynan 1997). Once in the bay, these adult salmon may be present in areas immediately adjacent to their home streams for up to 10 to 12 days before actually entering the rivers, acclimatizing and waiting for suitable water flows.

In the Hood Canal watershed, adult summer-run chum salmon arrive at their native river spawning grounds from early September through mid-October (WDFW and WWTIT 1994). Summer-run chum have been observed arriving at spawning grounds in the Big Quilcene River from September 11 through October 14, peaking on September 28 (Lampsakis 1994 as cited in Tynan 1997). Chum salmon mostly spawn in lower river and stream reaches below instream barriers that would require jumping, which they avoid (Salo 1991).

Egg incubation time in redds for summer-run chum salmon is dependant on water temperature. Fry emergence times from the gravel have been found to differ between Hood Canal east side streams (such as Big Beef Creek) and west side rivers and streams (such as the Dosewallips River) due to gradient and runoff differences (Tynan 1997). East side streams have low gradients and are primarily fed from rainfall, and west side rivers and streams have moderate to high gradients and are fed primarily from snowfall in the Olympic Mountains. This leads to differences in water temperature, which affects development time and thus timing of fry emergence.

Summer-run chum salmon egg development time can vary from 100% emergence 111 days after fertilization in the Quilcene National Fish Hatchery on the Big Quilcene River (Telles 1996 as cited in Tynan 1997), to 95% emergence at 177 days after fertilization in Big Beef Creek (Koski 1975 cited in Tynan 1997). Tynan (1997) estimates gravel residence times for combined east and west side Hood Canal rivers and streams as starting on September 1, with 90% completion by April 24. Gravel emergence times were estimated as starting on February 7, peaking on March 22, with 90% completed by April 14.

Following emergence from the gravel, summer-run chum fry migrate directly (within 24 hours) to estuary areas near the mouths of their natal streams and rivers, a process generally completed in 30 days for all fry in a given river (Salo 1991). At the Quilcene National Fish Hatchery, the USFWS observed fry clearing the Big Quilcene River in 6 to 12 hours (USFWS 1993 and 1994 as cited in Tynan 1997). Since chum fry complete downstream migration so quickly, Tynan (1997) considered estimates of gravel emergence timing (stated above) as being equivalent to seawater entry timing.

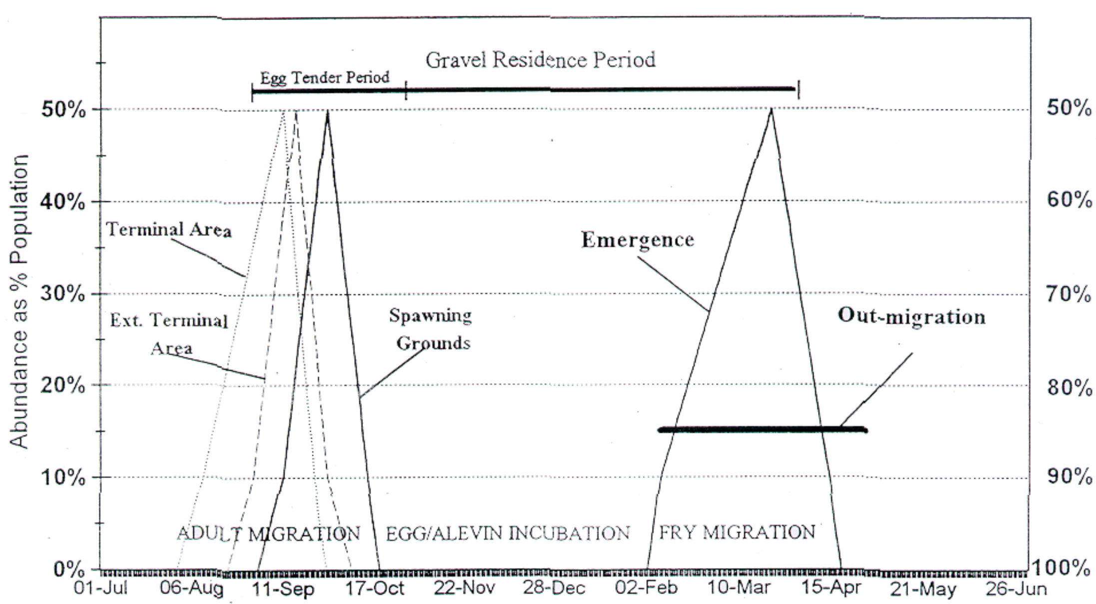
Once chum fry are in estuarine areas, they tend to concentrate in the top few meters of water, both day and night, likely utilizing less-saline upper water layers to acclimate (Bax 1983; Iwata 1982). Chum fry have also been observed to frequent areas immediately adjacent to shorelines, including nearshore habitats such as eelgrass beds (Bax 1983; Schreiner 1977; Phillips 1984). Chum fry are about 35 to 44 mm (1.4 to 1.7 inches) long (Fork Length [FL]) at this time. Chum fry in estuarine nearshore areas of Hood Canal have been documented to feed primarily on epibenthic (dwelling just above the bottom) invertebrate prey organisms such as harpacticoid copepods and gammarid amphipods (Simenstad and Kinney 1978). As the fish grow larger, they move into more open waters where they feed on pelagic prey organisms, including euphausids and calanoid copepods.

Chum salmon juveniles then leave Hood Canal for the open ocean, where they spend two to five years in the North Pacific Ocean before returning to spawn (Salo 1991). At migration rates of approximately 4.3 miles (7 km) per day, the southernmost (Union River) populations of juvenile summer-run chum salmon are estimated to exit Hood Canal in 14 days after individual fish enter saltwater, and the northernmost (Dosewallips River) populations are estimated to exit Hood Canal 6.5 days after individual fish enter saltwater (Tynan 1997). Chum salmon fry have been observed to migrate out of Hood Canal primarily along the eastern shoreline (Bax 1983; Schreiner 1977). Summer-run chum salmon in Hood Canal have shorter estuarine residence times than fall-run chum, which enter saltwater later in the spring when greater food resources are available (Tynan 1997).

Tynan (1997) estimates that summer-run chum salmon juveniles completely exit Hood Canal: (1) from February 21 through April 28 (central 80%) with a peak clearance date of April 1, for fish from east side rivers characterized by the Union River; and (2) from March 8 through April 21 (central 80%) with a peak clearance date of April 3, for west side rivers characterized by the Dosewallips River.

In summary, in-migrating adult summer-run chum salmon are present annually in the marine waters of the Dabob Bay and Hood Canal MOAs for a three-month period from early August through the end of October, in the top 30 feet (9.1 m) of the water column (Figure 5-2; Tynan 1997; WDFW 1999b). Out-migrating juvenile summer-run chum salmon are present in Hood Canal marine waters for another three-month period from early February through the end of April. Out-migrating juvenile salmon are found initially in nearshore areas in the top few meters of water, later moving more offshore and migrating out of Hood Canal primarily along the eastern shoreline (Bax 1983; Schreiner 1977).

Figure 5-2: Hood Canal Region Summer Chum Life History Summary for Washington State.



Source: Tynan 1997

5.1.2 Puget Sound Chinook Salmon

Chinook salmon are found on both sides of the North Pacific Ocean (Healey 1991). In Asia, chinook salmon runs are found from Hokkaido in Japan north to the Anadyr River in Eastern Siberia. In North America, they are found from central California through Kotzebue Sound in Alaska. Chinook salmon are anadromous, returning from the open ocean to spawn in their home rivers. Chinook salmon are the largest salmon species in size, and they prefer to spawn in mainstem channel areas in larger rivers. After emergence from their gravel redds, they migrate either directly to sea as fry (ocean type chinook), or as fingerlings after spending up to a year or more rearing in freshwater river environments (stream type chinook). The fry or fingerlings then reside in estuarine areas near their home rivers in spring and early summer, after which they migrate to the open ocean where they spend an average of 3 to 4 years before returning to spawn.

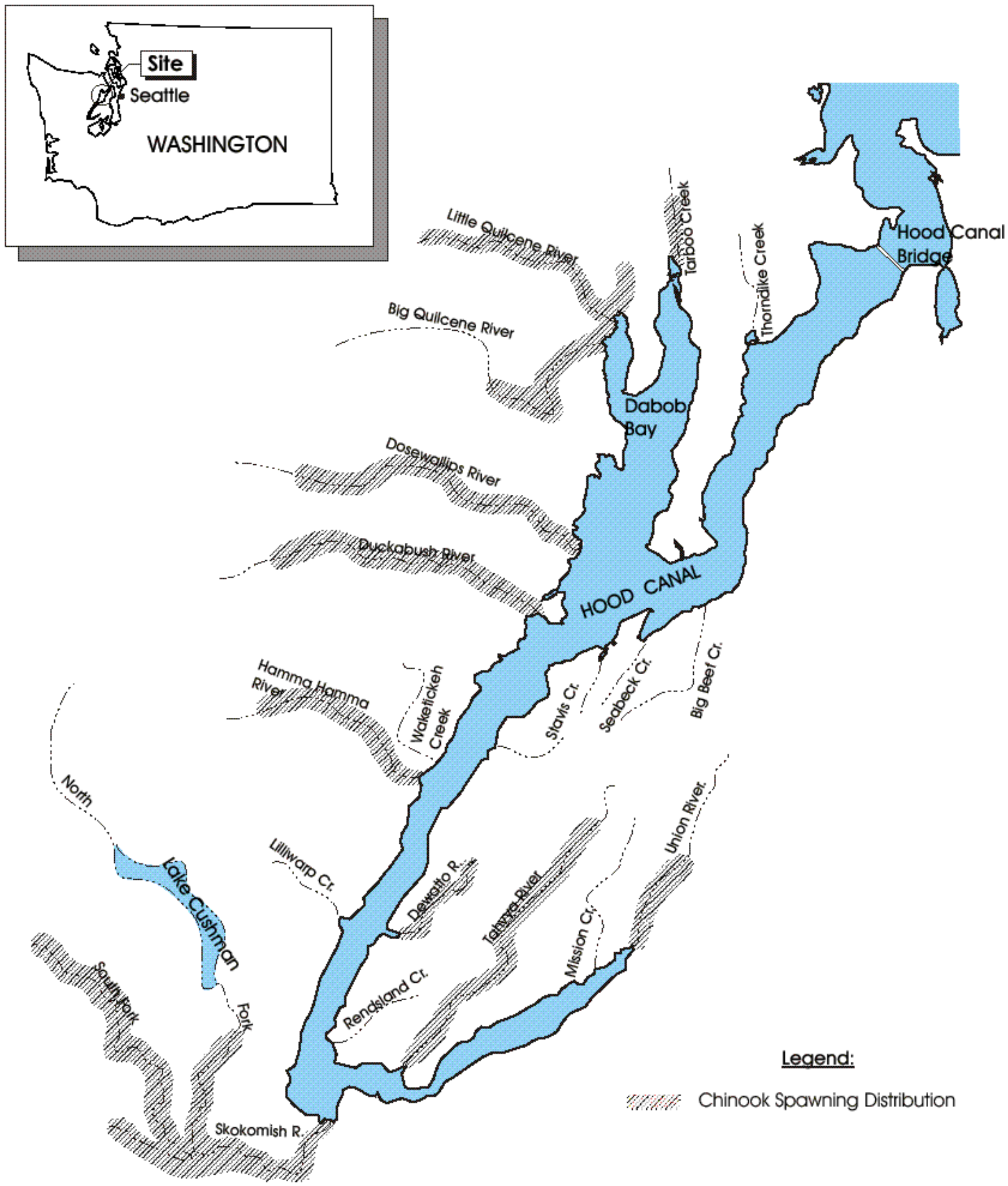
Historically, chinook salmon runs in Hood Canal have been primarily associated with larger rivers in the region with higher flows and larger spawning gravel, as opposed to smaller rivers and streams (Williams et al. 1975). Two spawning run types of chinook salmon exist in the Hood Canal watershed: summer/fall and spring runs. Rivers with summer/fall-run chinook include the Big Quilcene, Dosewallips, Duckabush, Hamma Hamma, Skokomish, Union, Tahuya, and Dewatto rivers (Figure 5-3). Williams et al. (1975) identifies spring-run chinook stocks in the Dosewallips and Duckabush rivers and states that a spring-run was formerly found in the Skokomish River. Summer/fall-run stocks return to spawn and begin upstream migration in Hood Canal rivers from mid-July through the end of October and spawn from late August through mid-November (Figure 5-4). Spring-run stocks return from mid-May through late August and spawn from mid-July through early October.

The 1992 Washington State Salmon and Steelhead Stock Inventory characterized the overall status of Hood Canal summer/fall chinook stocks as "healthy" (WDFW and WWTIT 1994). This was due primarily to stable wild run chinook returns in the Skokomish River. However, returns to smaller river systems in Hood Canal have not met escapement goals, including those on the Dosewallips, Duckabush, Hamma Hamma, Dewatto, Tahuya, and Union rivers (Table 5-2). These runs are considered small and "depressed." A map of chinook spawner distributions in Hood Canal in the 1992 inventory also shows runs in the Big and Little Quilcene rivers and in Lilliwaup Creek (Figure 5-3). The inventory states that historical data on spring chinook salmon runs in the Skokomish River and other streams are sparse, and if a spring-run still exists on the Skokomish, it is at very low levels.

Table 5-2: Hood Canal Summer/Fall Chinook Salmon Population Status by River.

River	Population Status
Dosewallips River	Depressed
Duckabush River	Depressed
Hamma Hamma River	Depressed
Dewatto River	Depressed
Tahuya River	Depressed
Skokomish River	Healthy

Source: WDFW and WWTIT 1994



Source: WDFW and WWTIT, 1994

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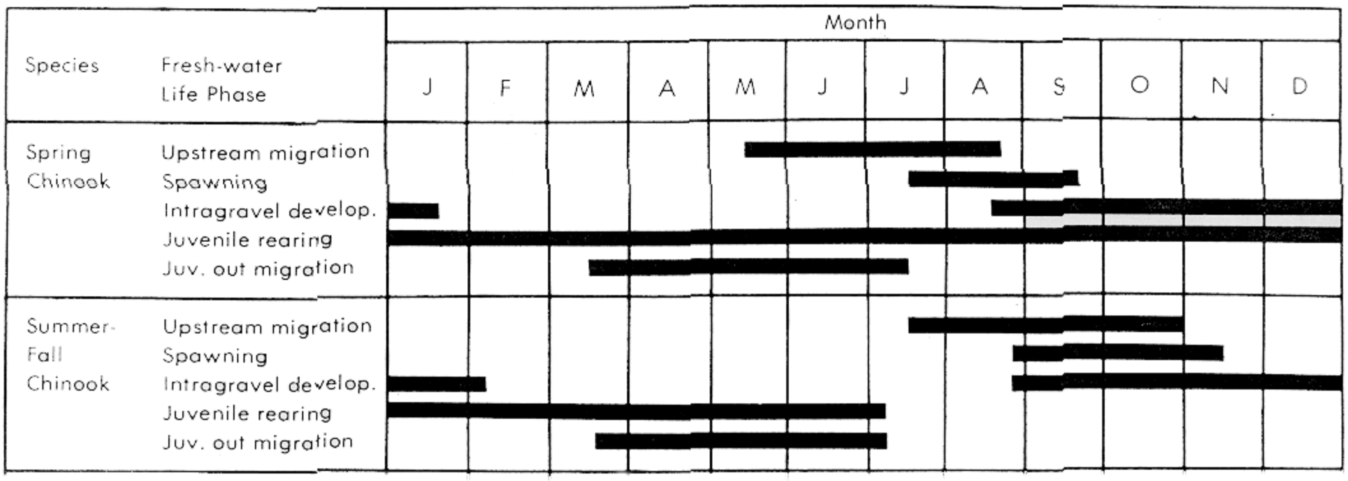
Hood Canal Summer/Fall Chinook Salmon Runs

Figure 5-3

Figure 5-4: Spring-Run and Summer/Fall-Run Chinook Freshwater Life Phases in Hood Canal.



Source: WDF 1975.

Summer/fall chinook salmon adults returning to spawn in the Big Quilcene, Dosewallips, Duckabush, Hamma Hamma, and Skokomish rivers begin upstream migration in Hood Canal rivers from mid-July through the end of October (Figure 5-4; Williams et al. 1975). These fish would pass through the waters of the Dabob Bay and Hood Canal MOAs. Salmon from these runs spawn from late August through mid-November. After an intra-gravel egg development period lasting from late-August through early February, the chinook fry begin either a juvenile freshwater rearing period from the beginning of January through early July, or they migrate downstream to estuarine areas from mid-March through early July.

Out-migrating juvenile chinook salmon smolts were caught at Bangor on Hood Canal from early May through July in a series of studies on out-migrating salmon from 1976 to 1979 (Bax et al. 1978; Bax et al. 1980; Schreiner et al. 1977). These studies found that migrating juvenile salmon were found primarily in nearshore areas in the top few meters of the water column, mostly on the east side of Hood Canal.

The above summer/fall time periods encompass life history event timing reported for spring-run chinook salmon in Hood Canal, with the exceptions that: (1) spring-run adults begin returning to their home rivers starting in mid-May as opposed to starting in mid-July, (2) freshwater rearing times are reported as lasting year round, and (3) juvenile out-migration lasts through mid-July (Williams et al. 1975).

In summary, returning adult Puget Sound chinook salmon are present annually in marine waters of the Dabob Bay and Hood Canal MOAs from mid-May through the end of October, although spring chinook runs may be low in number from mid-May through mid-July. In-migrating adult salmon tend to be found in the upper 30 feet (9.1 m) of the water column (WDFW 1999b).

Out-migrating juvenile Puget Sound chinook salmon are present in marine waters of Hood Canal from mid-February through the end of July, primarily in shallow, nearshore areas.

5.1.3 Coastal / Puget Sound Bull Trout

Bull trout are char in the family Salmonidae native to the Pacific Northwest and western Canada (63 FR 31693; June 10, 1998). The taxonomic status of bull trout has been confused with Dolly Varden (*Salvelinus malma*) in the past, with recognition of two separate species in 1978 (Cavender 1978). Due to the fact that the bull trout and Dolly Varden occur together in many rivers and are visually almost indistinguishable, the WDFW manages them together as "native char." Bull trout inhabit cold, freshwater streams and rivers (which remain primarily less than 15^{o}C [59^{o}F]) their entire lives, with some evidence for the existence of an anadromous, sea-going form, although this is considered uncertain (McPhail and Baxter 1996). McPhail and Baxter (1996) state:

> "The least common or, perhaps, the least studied life-history form is the anadromous bull trout. Anadromous populations are suspected in the Suquamish River (just north of Vancouver, British Columbia) and in the lower Fraser system… They probably also occur in a number of Puget Sound drainages (e.g., Nooksack, Skagit and Stillaguamish) and may once have occurred as far south as the Puyallup River (the species' type locality)."

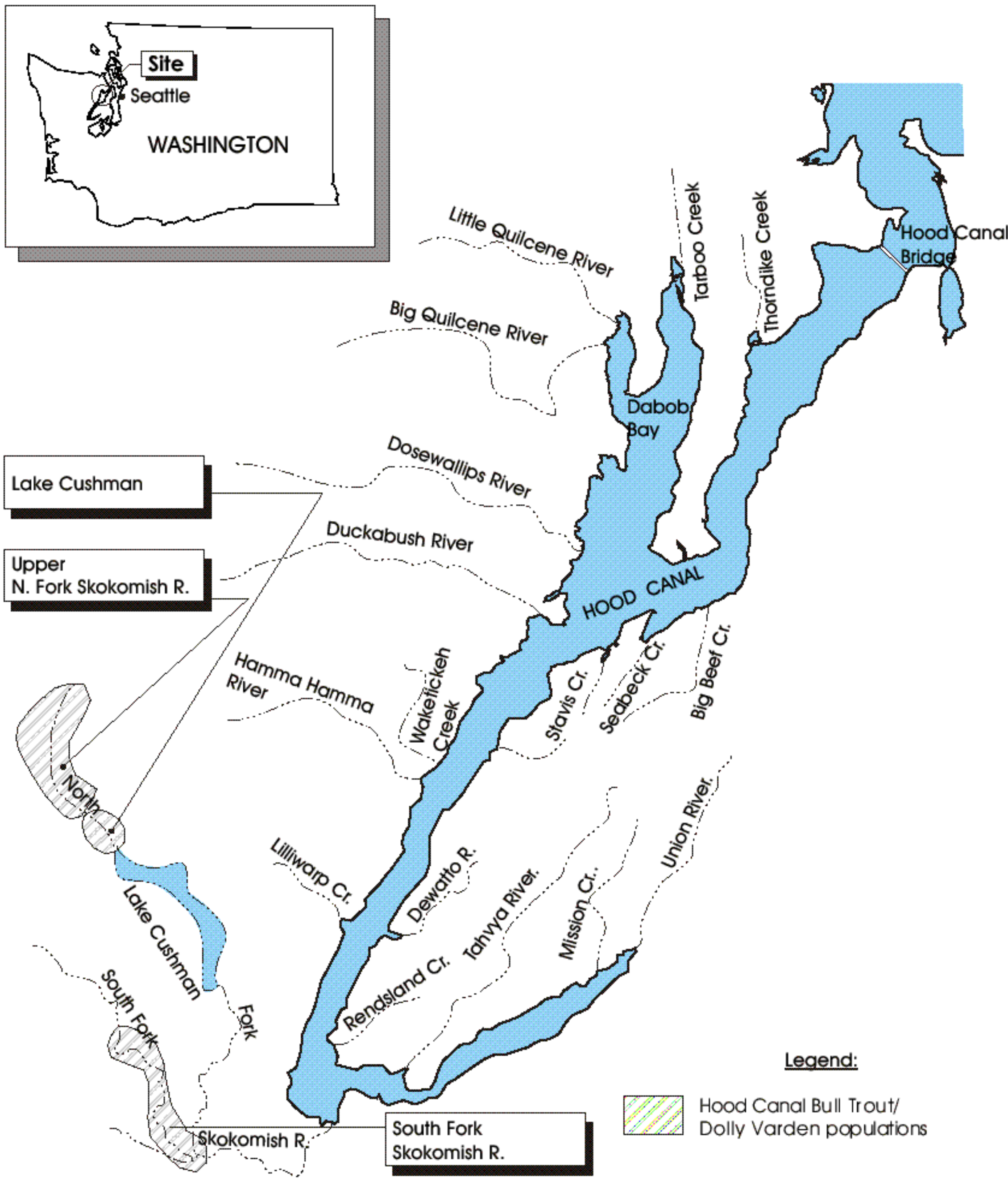
In Hood Canal, three separate stocks of bull trout occur in the Skokomish River watershed (Figure 5-5; Mongillo 1993; WDFW 1998). Although two bull trout were observed in the past on the Big Quilcene River, which flows into Dabob Bay, no bull trout have been seen since. Thus, it is not believed that a distinct Big Quilcene River population of bull trout exists.

Two of the Skokomish River stocks of bull trout are landlocked on the North Fork of the river. One stock is in the Lake Cushman Reservoir, and is considered "healthy" (Table 5-3). The other stock is above the Staircase waterfalls on the upper North Fork Skokomish. The status of this population is unknown. The third stock is on the South Fork Skokomish River; the status of this stock is also unknown.

Table 5-3: Bull Trout Populations in Hood Canal and their Stock Status.

Population	Stock Status	Anadromous Form Present?
South Fork Skokomish River	Unknown	Possible
Lake Cushman	Healthy	No – landlocked
Upper North Fork Skokomish River (above Staircase waterfalls)	Unknown	No – landlocked

Source: WDFW 1998



Source: WDFW 1998

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**Hood Canal Bull Trout/
Dolly Varden Populations**

Figure 5-5

It is possible that the South Fork Skokomish River stock has an anadromous form (WDFW 1998). The WDFW (1998) report states, in regard to this stock, that:

> "It is possible that the fluvial, anadromous, and resident life history forms are present. Emigrating anadromous smolts have been observed. A sample of 25 bull trout / Dolly Varden, collected in the anadromous zone, were analyzed by Dr. Robb Leary, University of Montana, in the spring of 1995. The analysis showed that all 25 fish were bull trout and that the fish in the sample showed very little genetic diversity."

Thus, it is possible that in-migrating adult bull trout and out-migrating juveniles from the South Fork Skokomish River could be present at certain times of year in the marine waters of the Dabob Bay and Hood Canal MOAs. Adult bull trout could be present in the summer / fall time period and juveniles could be present in spring / summer. As bull trout are salmonids, the following analyses of potential effects on listed species of salmon would apply to bull trout as well, if they are present.

5.2 Marine Mammals and Sea Turtles

5.2.1 Humpback Whale

Humpback whales occur worldwide but are considered endangered throughout their range (Angel and Balcomb 1982). Humpbacks were overhunted during the early 1900s and finally protected from commercial hunting in 1966. Population estimates for the North Pacific range from 1,407 (Baker and Herman 1987) to 2,100 individuals (Darling and Morowitz 1986). Humpbacks are primarily a coastal species that travel over deep pelagic waters migrating between high latitude feeding areas in Alaska and low latitude breeding grounds in Hawaii or Mexico (Department of the Navy 1999a). While the species was once common in Puget Sound, humpback whales are now only occasional visitors (Everitt et al. 1980). Every one to two years, a humpback whale is sighted in Puget Sound, even as far south as Budd Inlet near Olympia, but these visits to inland water are unusual (ROC, Calambokidis, 1999). Results of monitoring the movements of a humpback whale in Puget Sound during 1988 showed that this individual traveled as far south as Olympia, but no sightings were reported within Hood Canal or Dabob Bay (Calambokidis and Steiger 1990). Humpback whales feed on a variety of small schooling fishes and invertebrates. They can eat relatively large species such as cod (family *Gadidae*) and squid but prefer herring (*Clupea harengus*) and euphausiids. Dives for food generally last less than five minutes because Humpback prey are concentrated in the top 984 feet (300 m) of the water column. Humpbacks produce a variety of sounds in the range of 20 Hz to 10 kHz with an effective range of about 6.2 – 12.4 miles (10

– 20 km) (Department of the Navy 1999a). Source levels range from 144 to 174 dB and their songs can be detected by hydrophone at distances up to 9.3 miles (15 km) (Richardson et al. 1995). Data on the hearing ability of humpbacks, as for most whales, is lacking; because their communication is low frequency (LF), however, it is assumed that they have excellent LF hearing.

5.2.2 Steller Sea Lion

Steller sea lions range from St. Lawrence Island through the Aleutians and coastal Alaska and south to about Santa Barbara Island (Ronald et al. 1982). Most of the population occurs in the northern extent of the range (Angel and Balcomb, 1982). Population levels have declined dramatically in recent years, possibly due to a reduction in prey base.

Steller sea lions generally move into Puget Sound in the fall; by midwinter they may number several hundred (Angel and Balcomb 1982). They have been know to frequent Sucia Island, Race Rocks off southern Vancouver Island, and Sombrio Point in the northern sound but are rare south of Admiralty Inlet (Yates 1988). During El Niño years, Seller sea lions have been observed using Fox Island as a haulout, which is near Tacoma (ROC, Jeffries, 1999). Small groups (3-5 individuals) of Steller sea lions are observed in Hood Canal during a five-week period during late winter/early spring (ROC, James, 1999) before moving north to breeding sites. There are no Steller sea lion breeding sites in Puget Sound.

Steller sea lions feed on a variety of local fish including rockfish (*Sebastes* spp.), skate (*Raja* spp.), hake (*Marluccius productus*), salmon (*Oncorhynchus* spp.), halibut (*Hippoglossus stenolepis*), and black cod (*Anoplopoma fimbria*) as well as squid and octopus. Males grow to about 10 feet (3 m) and 1,980 lb (900 kg) while females grow to 6.6 feet (2 m) and 660 lb (300 kg). There are no data available about the underwater hearing and sound production in Steller sea lions, but they do produce a variety of clicks and growls (Department of the Navy 1999a).

5.2.3 Leatherback Sea Turtle

Leatherback sea turtles are the largest of all sea turtles, reaching 8 feet (2.4 m) and weights of 1,600 lbs (725 kg). These turtles range widely through the tropics and subtropics and migrate seasonally into Arctic and Antarctic waters. Leatherback sea turtles are pelagic and occur off the Washington coast. They occasionally enter bays and estuaries. Leatherback sea turtles can dive to 4,250 feet (1,295 m) and can swim up to 4.5 mph (7.2 km/hr). Their sole prey is jellyfish. Leatherback sea turtles have been known to ingest plastic bags and other debris that resemble jellyfish. Breeding areas are in tropical and subtropical zones (Storm and Leonard 1995).

There are no published studies available on the hearing capability of leatherback sea turtles (Department of the Navy 1999a). Studies of another species, the green sea turtle (*Chelonia mydas*), suggest that they have a hearing range of about 60 to 1,000 Hz, with optimal hearing between 200 and 700 Hz (Ridgway et al. 1969).

5.3 Terrestrial Species

5.3.1 Bald Eagle

Bald eagles are currently listed as threatened in Washington but have been proposed for delisting. While bald eagles are expected to be delisted within the next year, their numbers will continue to be monitored as part of the delisting process, and they will still be protected under the Federal Bald and Golden Eagle Protection Act. Breeding and wintering bald eagles are commonly found along the Puget Sound coastline. Nests are built in dominant trees, primarily Douglas-fir in Puget Sound, within 656 feet (200 m) of open water. Bald eagle territories average 0.4-0.8 square miles (1-2 km^2) (Stalmaster 1987) but may be as large as 3.1 square miles (8 km^2) in Washington (Grubb 1976). During the winter, bald eagles often congregate in communal roosts during the evening. These sites are chosen for favorable microclimate that protect eagles from harsh weather (Stalmaster 1987).

Twenty-five bald eagle nesting territories have been identified in the Dabob Bay project area (WDFW 1999a). In addition, the WDFW has identified two communal roosts in the vicinity. One is located up the Big Quilcene River valley (exact location unknown) and the second is located north of Pulali Point, which is on the west side of Dabob Bay (Figure 5-6). Both communal roosts are inland and away from all Navy activity on Dabob Bay.

5.3.2 Marbled Murrelet

Marbled murrelets, a threatened species under the ESA, are small sea birds that range from southeast Alaska to Santa Cruz in northern California. Unlike other seabirds that nest in ground burrows, it is the only alcid that nests in trees. Marbled murrelets are closely associated with old-growth conifer stands and trees that are 150+ years and >35 in (89 cm) diameter at breast height (dbh) (Binford et al. 1975; Carter and Sealy 1987). The nesting season extends from April 1 to September 15. The WDFW has mapped several marbled murrelet breeding areas west of Highway 101 in the Big Quilcene River basin. Documented breeding sites are no closer than 2.5 miles (4 km) of the Dabob Bay shoreline.

Marbled murrelets feed in Puget Sound throughout the year, with larger concentrations in limited areas during the fall and winter. These birds feed within 1.2 miles (2 km) of shore and dive for sand lances (*Ammodytes hexapterus*), sea perch (*Embiotoca lateralis*), other small schooling fish and crustaceans. Open waters of entrance channels off rocky shores or over reefs are important feeding locations (Angel and Balcomb 1982). Surveys conducted by along Hood Canal (Sustainable Ecosystems Institute 1997) indicate that numbers of marbled murrlets increased from 200 to 400 from October through November. Distribution of birds varied throughout the season and most marbled murrelets were observed within 1,640 feet (500 m) of shore.

Figure5-6 has been omitted from this version of the Dabob Bay Biological Assessment. It contains sensitive information that is not intnded for release to the general public.

Figure 5-6 Bald Eagle Nesting Sites

5.3.3 Northern Spotted Owl

Northern spotted owls, listed as a threatened species under the ESA, are found in the Pacific coastal region from British Columbia to Marin County, California. An abundance of research indicates that spotted owls are strongly associated with late successional and old-growth forests. The spotted owl occurs in areas within most of its historic range, but its distribution has been altered from long-term effects of habitat removal and alteration. Nesting occurs in mature and old-growth stands that contain a high degree of structural complexity. Roosting habitat is similar to nesting habitat. Younger forest types may be used where the structural attributes of older forests are present (Washington Department of Natural Resources [WDNR] 1997). Spotted owls are nocturnal hunters that feed on small mammals. Flying squirrels (*Glaucomis sabrinus*) are the primary prey on the Olympic Peninsula (Carey et al. 1992). Breeding activity begins in late winter, and the young owls disperse from the nest in September or October. The median home range for spotted owls on the Olympic Peninsula is over 14,000 acres (5,665 ha) (WDNR 1997).

A circular management zone (2.7-mile [4.3 km] radius) has been set by the USFWS around known spotted owl nests that restricts certain land use practices. WDFW Priority Habitat and Species (PHS) data indicate the occurrence of several spotted owl management circles west of Quilcene Bay. Two management circles extend into Quilcene Bay where it joins Dabob Bay; one of these extends across Quilcene Bay onto the western shoreline of the Bolton Peninsula between Quilcene Bay and Dabob Bay. No spotted owl breeding locations were identified on the Toandos Peninsula or on Whidbey Island.

6.0 ANALYSIS OF EFFECTS

The potential effects to fish and wildlife of continued range testing in Dabob Bay by the Navy can be placed in two categories. The first category includes those actions that may disturb species using the shoreline of Dabob Bay, such as bald eagles. The marbled murrelet and northern spotted owl breeding areas would not be affected by the continued use of the DBRC. The marbled murrelet and northern spotted owl occupy habitats that are several miles from the Navy's water-based activities. In addition, other than minor vegetation maintenance at the existing Zelatched Point facilities, no habitat modification or new facilities are proposed. Therefore, further potential impact discussion regarding terrestrial species focuses on bald eagle and marbled murrelet use of aquatic and terrestrial habitat near the shoreline.

The second category includes those activities that may affect fish and marine mammals from in-water disturbance, noise, and other ancillary impacts. The potential for noise impacts to fish and marine mammals requires a brief discussion of the properties of noise in water and the associated Navy components that produce noise.

6.1 Underwater Noise

Sound is measured in the logarithmic scale of decibels (dB), which approximates the way in which humans perceive sound. The dB refers to a standard that is used for comparison of different noise levels. The compressed logarithmic scale allows for comparisons of a wide range of sounds from a soft breeze to a large explosion. In addition, the units for sound in air and those for sounds in water are different. The standard for atmospheric sound is 20 micro-Pascals (20µPa); the standard for water-borne sound is 1µPa. To make comparisons of noise levels, 26 db must be subtracted from water-borne noise levels (1µPa) to roughly estimate atmospheric noise levels (20µPa) (NRDC 1999). In this report, all references for atmospheric sound are referenced in 20µPa dB units, while all references to water-borne sound are made in 1µPa dB units.

Sound travels as a series of disturbances compressing and relaxing the medium it travels through, whether air or water. The frequency of a sound wave is the number of disturbances, or cycles, that pass a fixed point per second. Cycles per second are referred to in units of Hertz (Hz) or kilohertz (kHz, or 1,000 Hz). Low frequency sound is considered to be below 1,000 Hz and is the type of noise produced by large ships and the vocalizations of large whales. Most fish and marine mammals appear to hear or react to low frequency sound (Department of the Navy 1999a; NRDC 1999). Mid-frequency noise is from 1,000 Hz – 10,000 Hz and is produced by marine mammals (primarily odontocetes, the toothed whales), precipitation, and tactical sonar. High frequency noise is above 10,000 Hz and is produced by snapping shrimp, ecolocation of marine mammals, ship depth finders, and fish finding sonar (Department of the Navy 1999a).

Because most fish and marine mammals appear to most acutely hear LF sounds and the vast majority of sound produced by Navy activity in Dabob Bay is LF sound, this analysis focuses on potential LF noise effects. The primary sources of underwater noise are from boat propellers, torpedo propulsion systems, underwater tracking signals, tracking pingers attached to test torpedoes, underwater submarine simulators, and the occasional presence of a submarine. Noise from the larger boats and submarine propellers is LF sound in the range of 160 – 170 dB (Department of the Navy 1999a; NRDC 1999; Richardson et al. 1995). Smaller boats with outboard motors on the range are expected to produce sound levels of 150-160 dB or less (Richardson et al. 1995). Underwater tracking systems used in Dabob Bay referred to as Phase Shift Keyed (PSK) or Spaced Frequency Shift Keyed (SFSK) systems produce sounds of 194 dB in the 35 – 75 kHz range. Pingers, which are sound locators attached to test torpedoes, produce sounds of 168 dB at 37 kHz or 45 kHz. Pingers produce a short (10msec) sound that is repeated a 1 second intervals. A towed submarine simulator (TOSS) is used for about 10 tests per year and produces sounds in the 100 Hz to 10kHz range at 170 dB.

The estimated sound level of in-water activities associated with the DBRC are summarized in Table 6-1.

Table 6-1. Primary In-water Noise Sources in the DBRC.

Source	Noise frequency	Noise intensity	Signal duration range
Large boats and submarines (engine noise)	50 – 150 Hz	160 – 170 dB	continuous when running
Small boats and torpedoes (engine noise)	100 – 1,000 Hz	150 – 160 dB	continuous when running
Tracking sonar	35 – 75 kHz	194 dB	pulses < 0.5 seconds
End of run pingers	37 or 45 kHz	168 dB	< 0.5 seconds
Sonar transmissions (torpedoes, range targets and special tests)	8 – 68 kHz	225 dB	< 0.5 seconds
Towed submarine simulator (TOSS)	100 Hz – 10 kHz	170 dB	1 second to several minutes; peak values 1 – 10 seconds
Fleet sonar (surface ships, aircraft, and submarines)	50 Hz – 8 kHz 15 – 40 kHz	247 dB 238 dB	0.5 – 10 seconds; mostly 0.5 – 1 seconds
Aid to navigation (range equipment)	74 – 76 kHz	210 dB	1 second every 2 seconds

6.2 Fisheries

It is clear from information presented earlier in this Biological Assessment that naturally spawned summer-run chum and Puget Sound chinook salmon are present at various life stages and times of year in the marine waters of the

Dabob Bay and Hood Canal MOAs. It is less certain whether individuals of anadromous bull trout from the South Fork Skokomish would be present in marine waters of Dabob Bay and Hood Canal. Even if they are present, they would be in very low numbers.

A summary of the presence and timing by life stage for the above fish species in the marine waters of the Dabob Bay and Hood Canal MOAs is presented in Table 6-2. As stated earlier, in-migrating salmon tend to be found in the top 30 feet (9.1 m) of the water column (WDFW 1999b); out-migrating juvenile salmon are initially found in nearshore waters in the top few meters, later moving into more offshore waters (Bax 1983; Schreiner 1977). Out-migrating juvenile salmon primarily use the eastern side of Hood Canal.

Chum and chinook salmon and bull trout are all species in the Family Salmonidae with similar biology and life histories. Therefore, potential effects of ongoing and future operations of the Dabob Bay and Hood Canal MOAs on these three species of fish are discussed together as potential effects on salmonids.

No direct impacts to fish habitat would result from ongoing or future operations of the Dabob Bay and Hood Canal MOAs, such as those which would be associated with shoreline construction and other activities. This would include fish habitat supporting the invertebrate epibenthic organisms preyed upon by juvenile salmonids during their estuarine residence time. The potential impacts to the environment from ongoing and future Dabob Bay and Hood Canal MOA operations would be limited to water quality and acoustic effects on marine waters and organisms (MAKERS 1999).

Table 6-2: Marine Life Stage Presence and Timing of Fish Species Listed or Proposed for Listing Under the Endangered Species Act in Waters of the Dabob Bay and Hood Canal MOAs.

Species/ESU	In-Migrating Adults	Out-Migrating Juveniles
Hood Canal summer-run chum salmon	early August to end of October	early February to end of April
Puget Sound chinook salmon	mid-May to end of October	mid-February to end of July
Coastal/Puget Sound bull trout (anadromous form)	summer/fall ?	spring/summer ?

Source: Williams et al. 1975; Tynan 1997; Wydoski and Whitney 1979.

6.2.1 *Preferred Alternative*

Potential Water Quality Effects

Potential water quality effects of operations conducted under the OMP at the DBRC can be categorized as: (1) torpedo exhaust gas releases into the water; (2) accidental spills of fuel oil, torpedo propellants, and other substances; (3) increased turbidity arising from seabed disturbance during recovery of buried torpedoes and other devices; and (4) potential heavy metal leaching into sediments and the water column from lead anchors and copper core guidance wire on the sea bottom (MAKERS 1999). Each of these is analyzed separately below.

The Navy recently commissioned the Battelle Marine Sciences Laboratory (MSL) to conduct a field study to document current water and sediment quality conditions at the DBRC test range in Dabob Bay, and to assess potential impacts to water and sediment quality from decades of Navy use of the test range (Crecelius 2001). A copy of the study report is found in Appendix D of the Navy's Dabob Bay Range Environmental Assessment (U.S. Navy 2001).

In January of 2001, the Battelle MSL collected sediment and water samples in Dabob Bay on the DBRC test range. Surface sediment samples were collected at 14 stations on the bottom of Dabob Bay along the main axis of the DBRC test range (Figure 1 in Crecelius, 2001). Seawater samples were also collected at four of these stations at 1 meter below the surface and 10 meters above the bottom. The sediment and seawater samples were analyzed for cadmium (Cd), copper (Cu), lithium (Li), lead (Pb), zinc (Zn) and zirconium (Zr), elements identified as being present in torpedo exhaust, and /or anchor and dropper weights and other debris generated by operations at the DBRC.

Laboratory analysis results for both the surface and bottom seawater samples collected by the Battelle MSL indicate that metal analytes were present at low levels in Dabob Bay, comparable to background levels present in non-urban portions of Puget Sound (see Tables 7 and 9 in Crecelius, 2001). The four metals (Cd, Cu, Pb, and Zn) with listed Washington State water quality criteria, had concentrations well below these criteria. Lithium and zirconium do not have Washington State water quality criteria, but the lithium concentrations present were at the same level as those naturally occurring in the ocean. The zirconium concentrations observed were well below levels considered toxic to aquatic organisms.

Exhaust Releases

The majority of underwater vehicle exhaust gas components would quickly dissipate in the water column and would not require tidal action to reach non-toxic levels. There are no studies in the published scientific literature that discuss the specific components of the test torpedoes in a similar test setting. Applicable studies in the scientific literature and known toxicology data are used for comparative purposes in the following discussion.

Otto Fuel II Powered Torpedoes - Otto Fuel II is a monopropellant used in MK 46, MK 48, and other torpedoes (Royal Military College [RMC] and University of British Columbia [UBC] 1996). Otto Fuel combustion products present in torpedo exhaust are listed in Table 6-3, and include carbon monoxide, water, methane, carbon dioxide, nitrogen gas, nitrogen dioxide, hydrogen gas, miscellaneous hydrocarbons, and hydrogen cyanide (NUWC 1994). A total of 53 lbs (24.85 kg) of exhaust constituents are produced in a single run of the MK 46 torpedo, 335 lbs (150.75 kg) are produced by the MK 48 torpedo, and 506 lbs (227.7 kg) are produced by the MK 48 ADCAP (Advanced Capacity) torpedo (NUWC 1994).

Table 6-3: Exhaust component list for Otto Fuel II propelled torpedoes.

Exhaust constituent	Percent	MK 46 (lbs)	MK46 (kg)	MK 48 (lbs)	MK 48 (kg)	MK 48 ADCAP (lbs)	MK 48 ADCAP (kg)
Carbon monoxide	38.0%	20.14	9.06	127.3	57.28	192.28	86.53
Water	20.0%	10.60	4.77	67.0	30.15	101.20	45.54
Methane	11.0%	5.83	2.62	36.85	16.58	55.66	25.05
Carbon dioxide	9.5%	5.04	2.27	31.82	14.32	48.07	21.63
Nitrogen	8.7%	4.61	2.07	29.14	13.11	44.02	19.81
Nitrogen dioxide	8.0%	4.24	1.91	26.80	12.06	40.48	18.22
Hydrogen	4.0%	2.12	0.95	13.40	6.03	20.24	9.11
Hydrocarbons	0.5%	0.26	0.12	1.67	0.75	2.53	1.14
Hydrogen cyanide	0.3%	0.16	0.07	1.00	0.45	1.52	0.68
Total amount per run	100.0%	53.0	23.85	335.0	150.75	506.0	227.7

Source: NUWC 1994

Exhaust Gases - The exhaust components likely released in gaseous form include carbon monoxide, methane, carbon dioxide, nitrogen, nitrogen dioxide, hydrogen, and miscellaneous hydrocarbons. Carbon dioxide is the most soluble of these gases in water (Lide 1991; Stumm and Morgan 1996). Some proportion of the carbon dioxide gas would react with water to form carbonic acid and other components of the carbonate system, the ionic forms of which are natural constituents of seawater (Stumm and Morgan 1996). The rest of the carbon dioxide would be released into the air. Thus, the release of this gas would have no adverse effects on aquatic organisms.

The remaining exhaust gases released from Otto Fuel II powered torpedoes (carbon monoxide, methane, nitrogen, nitrogen dioxide, hydrogen, and miscellaneous hydrocarbons) do not react or ionize in seawater and have low solubility in water (Lide 1991; Stumm and Morgan 1996). With the possible exception of carbon monoxide, these gases would eventually escape into the atmosphere after being initially dissolved in seawater, with no adverse effects to marine organisms. A study of exhaust emissions from two- and four-stroke outboard engines, which emit exhaust into the water, found that: "the emitted gases [CO, NO_x, and HC], which are very volatile and have poor solubility in water, are stripped by the intense gas flow from the water and are finally introduced into the air" (Juttner et al. 1995). Since this study examined exhaust releases from engines mounted on test stands in very shallow water, the process described may be delayed by exhaust releases in deep water.

One recent study indicates that high concentrations of carbon monoxide in water can cause fish kills (Kempinger et al. 1998). Major fish kills were linked to the release of carbon monoxide into the Fox River in Wisconsin from exhaust produced by an outboard motor testing facility. The facility ran many outboard engines simultaneously for long periods of time each day. Thus, carbon monoxide levels built up in the limited dilution water available in the river, before being released into the atmosphere. The authors of the study drew their conclusions from measurements of carbon monoxide bound to hemoglobin in the blood of the killed fish, and did not measure carbon monoxide concentrations in the water. These measurements were not taken due to the fact that "no instrument existed that directly measures CO in water."

In comparison, it is unlikely that carbon monoxide releases from Otto Fuel II powered torpedoes would result in fish kills as the releases are: (1) limited in number; (2) limited in duration to the time of individual test runs; (3) emitted over the entire 14,000-yard (12,796 m) length of a test run, which effectively dilutes carbon monoxide concentrations to very low levels at any one location; (4) diluted into the large amount of water available for dilution and mixing in Dabob Bay or Hood Canal, as opposed to the limited dilution water available in a river; and (5) only temporarily in the water column before being released into the atmosphere.

Hydrogen Cyanide - The exhaust components likely present in either liquid and/or gaseous form include water, and hydrogen cyanide. While water would obviously dissipate quickly into the surrounding seawater with no toxic effects, hydrogen cyanide is very soluble and toxic to marine organisms at certain concentrations (Lide 1991; PSEP 1991). The federal and Washington State water quality criterion for protection of marine organisms from acute toxicity from hydrogen cyanide is 1.0 μg/L or parts per billion (ppb)(EPA, 1991; Chapter 173-201A Washington Administrative Code [WAC]). This criterion is defined as a "1-hour average concentration not to be exceeded more than once every three years on the average". However, the state acute criterion for cyanide is higher (less restrictive) in waters roughly east of Rosario Strait and south of the entrance to Admiralty Inlet, which includes the waters of Hood Canal and Dabob Bay. The state marine acute water quality criterion for cyanide in these waters is 9.1 μg/L or ppb. The long test run distance (14,000 yards [12,796 m]) of the Otto Fuel II powered torpedoes will effectively dilute the exhaust component concentrations to very low levels, which will quickly dissipate to levels below the water quality criterion for cyanide.

The amount of hydrogen cyanide released during a single test run of the MK 46 torpedo is 0.16 lb (71.55 g). If this amount of cyanide is distributed along the entire 14,000 yard (12,796 m) test run distance, 0.005592 grams would be released in each linear meter of the run. If this amount of hydrogen cyanide were diluted into 1 cubic meter of water at that spot, a concentration of 5.59

ppb would be initially present at each linear meter of the test run. This amount is below the less restrictive state criterion of 9.1 ppb, but exceeds the federal criterion of 1.0 ppb. If the 0.005592 g is dissipated into 5.59 cubic meters of water, this criterion will be met. This volume of water would be contained in a 1-meter wide cylinder of water with a radius of 4.36 feet (1.33 m).

The amount of hydrogen cyanide released during a single test run of the MK 48 torpedo is 1.01 lbs (452.25 g). If this amount of cyanide is distributed along the entire 14,000 yard (12,796 m) test run distance, 0.035343 grams would be released in each linear meter of the run. If this amount of hydrogen cyanide were diluted into 1 cubic meter of water at that spot, a concentration of 35.34 ppb would be initially present at each linear meter of the test run. This amount exceeds both the federal criterion of 1.0 ppb and the less restrictive state criterion of 9.1 ppb. If the 0.035343 g is dissipated into 35.34 cubic meters of water, the 1.0 ppb criterion will be met. This volume of water would be contained in a 1-meter wide cylinder of water with a radius of 10.99 feet (3.35 m). If the 0.035343 g is dissipated into 3.88 cubic meters of water, the 9.1 ppb criterion will be met. This volume of water would be contained in a 1-meter wide cylinder of water with a radius of 3.64 feet (1.11 m).

The amount of hydrogen cyanide released during a single test run of the MK 48 ADCAP torpedo is 1.52 lbs (683.1 g). If this amount of cyanide is distributed along the entire 14,000 yard (12,796 m) test run distance, 0.053384 grams would be released in each linear meter of the run. If this amount of hydrogen cyanide were diluted into 1 cubic meter of water at that spot, a concentration of 53.38 ppb would be initially present at each linear meter of the test run. This amount exceeds both the federal criterion of 1.0 ppb and the less restrictive state criterion of 9.1 ppb. If the 0.053384 g is dissipated into 53.38 cubic meters of water, the 1.0 ppb criterion will be met. This volume of water would be contained in a 1-meter wide cylinder of water with a radius of 13.51 feet (4.12 m). If the 0.053384 g is dissipated into 5.87 cubic meters of water, the 9.1 ppb criterion will be met. This volume of water would be contained in a 1-meter wide cylinder of water with a radius of 4.49 feet (1.37 m).

It is likely that these amounts of dilution would be quickly achieved given tidal current mixing available in the DBRC and the active dispersion of the exhaust into a plume behind the torpedoes. It is also likely that concentrations of cyanide at any one location of a test run would be below criteria if averaged over one hour (as per the above definition), as the torpedo passes through each linear meter of the test run very quickly. Hydrogen cyanide does not bioaccumulate to any significant degree. Hydrogen cyanide in low (non toxic) concentrations is biodegradable by almost all organisms (PSEP 1991).

A study of potential torpedo exhaust gas impacts to water quality was recently conducted at the Canadian Forces Maritime Experimental Test Ranges

(CFMETR) at Nanoose, British Columbia (RMC and UBC 1996). In this study, water samples of torpedo wake water and gas bubble plumes were collected at various depths up to 75 feet (23 m) and analyzed for Otto Fuel and hydrogen cyanide (one component of Otto Fuel exhaust). Samples were taken immediately after the passage of a torpedo and at 10, 20, and 30 minutes after passage. Neither Otto Fuel or hydrogen cyanide were detected in any of the samples at or above the achievable laboratory detection limits of 1 ppb and 5 ppb, respectively. This study concluded that chemical and oceanic mixing processes present in the environment reduced concentrations of these toxicants to below detection limits and that environmental impacts were negligible.

Field observations by NUWC Division Keyport personnel indicate that for torpedoes tested in waters less than 100 feet deep in calm waters, a visible plume or path of gas bubbles appears on the surface approximately 30 seconds after a torpedo passes through an area. When the bubble path first appears it is approximately 2 feet wide, growing to a width of approximately 6 feet wide in about 5 minutes. The bubbles then dissipate completely over another 2 to 3 minutes. The presence of wind waves on the water speeds up the spreading and dissipation process.

This visible gas bubble plume or path created in the wake of passing torpedoes represents a zone of initial dilution for torpedo exhaust products, which is quickly achieved. Most, if not all the dilution process required to meet the state water quality criterion of 9.1 ppb for hydrogen cyanide released in the exhaust of the three torpedo types discussed above, would be achieved during the first 5 minutes of this initial dilution process. This initial dilution would conservatively take place in a six foot (1.83 m) diameter or 3 foot (0.91 m) radius cylinder of water centered on the axis of the torpedo path, based on the field observations above. This volume of water would actually quickly rise to the surface and likely change shape providing even more initial dilution volume. A somewhat longer time would be required to meet the federal water quality criterion of 1.0 ppb, but this will very likely be accomplished in a short enough time period to meet the one hour average concentration part of the water quality criteria regulations.

Underwater Vehicles Powered by the Exotic Rocket Motor Propulsion System - Table 6-4 shows the maximum amount of individual exhaust components that would be released during a single test run of underwater vehicles powered by the ‘exotic’ rocket motor propulsion system. The exhaust products are released in two conical plumes behind the vehicle. No more than 12 of these test runs would be conducted annually. These exhaust components are released over the course of 14,000-yard (12,796 m) test runs. The fact that exhaust is released continuously over this distance effectively dilutes the exhaust component concentrations to very low levels at any one location of the test run distance. Infrequent stationary tests of this propulsion system, which would release approximately 60 percent of the amounts in Table 6-4, are also planned.

The two conical plumes of exhaust products produced during these tests would each be approximately 25 feet (7.62 m) long. Stationary tests would be conducted twice a year on average and would consist of running the propulsion system for 10 seconds each time.

Exhaust Gases - The exhaust components likely released in gaseous form include carbon monoxide, carbon dioxide, ethane, methane, hydrogen chloride, hydrogen, and nitrogen. Effects from these exhaust gases would be similar to those previously described above for Otto Fuel II.

Table 6-4: Exhaust component list for 'exotic' rocket motor propulsion system.

Species		Weight (lbs)	Probable Form
Carbon	C	0.4276	solid
Carbon monoxide	CO	36.1117	gas
Carbon dioxide	CO_2	4.7100	gas
Ethane	C_2H_6	0.0002	gas
Methane	CH_4	0.9514	gas
Hydrogen chloride	HCl	44.4385	gas
Iron chloride	$FeCl_2$	0.0760	solid
Hydrogen	H_2	2.7501	gas
Water	H_2O	33.0095	liquid
Hydrogen cyanide	HCN	0.0002	gas/liquid
Nitrogen	N_2	17.8197	gas
Ammonia	NH_3	0.0040	gas/liquid
Zirconium oxide	ZrO_2	1.2343	solid
Total		171.5333	

The following discussion highlights those effects that are different than discussed under Otto Fuel II

Hydrogen Cyanide and Ammonia - The federal and Washington State water quality criterion for protection of marine organisms from acute toxicity from hydrogen cyanide is 1.0 μg/L or parts per billion (ppb) (EPA 1991; Chapter 173-201A Washington Administrative Code [WAC]). This criterion is defined as a "1-hour average concentration not to be exceeded more than once every three years on the average." However, the state acute criterion for cyanide is higher (less restrictive) in waters roughly east of Rosario Strait and south of the entrance to Admiralty Inlet, which include the waters of Hood Canal and Dabob Bay. The state marine acute water quality criterion for cyanide in these waters is 9.1 μg/L or ppb. The amount of hydrogen cyanide released during a single test run is 0.0002 lb (0.091 g). If this amount is distributed along the entire 14,000-yard (12,796 m) test run distance, 0.000007112 gram would be released in each linear meter of the run. If this amount of hydrogen cyanide were diluted into 1 cubic meter of water, a concentration of 0.007112 ppb would be present at each linear meter of the test run, which is well below both the federal and state water quality criterion of 1 ppb and the higher state criterion of 9.1 ppb for waters south of the mouth of Admiralty Inlet, including Hood Canal and Dabob Bay.

Sixty percent of the 0.091 grams of hydrogen cyanide released during a test run, or 0.055 gram, would be released during a stationary test of the 'exotic' propulsion system. To reach the water quality criterion level of 1 ppb, this amount of hydrogen cyanide would need to be diluted into approximately 55,000 liters or 55 cubic meters of water. This volume of water would be contained in two 25 foot (7.62 m) long cones, each with a base radius of 6.09 feet (1.86 m). To reach the higher water quality criterion level of 9.1 ppb, 0.055 gram of hydrogen cyanide would need to be diluted into approximately 6,044 liters or 6.044 cubic meters of water. This volume of water would be contained in two 25 foot (7.62 m) long cones, each with a base radius of 2.02 feet (0.61 m). It seems likely that these amounts of dilution would be quickly achieved given the short duration of the test and the active dispersion of the exhaust from the underwater vehicle into a plume surrounding the vehicle. It is also likely that concentrations of hydrogen cyanide would be below the one-hour criteria.

Ammonia in seawater is present in both ionized (NH_4^+) and un-ionized (NH_3) forms, the ratio depending on ambient seawater salinity, temperature, and pH (EPA 1989). The un-ionized form is toxic to aquatic organisms. The water quality criterion for ammonia thus changes according to ambient conditions. Representative salinity, temperature, and pH values for Dabob Bay of 28 parts per thousand (ppt), 13^{o}C, and 8.4 were chosen, respectively, from water quality data collected by the Washington State Department of Ecology (WDOE) at Station HCB002 in Dabob Bay on May 11, 1987 (WDOW 1999b; no data available for this station after 1987 or in winter months). Given these ambient values, the federal and state water quality criterion for acute toxicity from total ammonia (total for both forms) would be 4.89 mg/L or parts per million (ppm), as calculated in spreadsheets produced by WDOW (WDOE 1999c). It is also likely that concentrations of ammonia would be below criteria if averaged over one hour (as per the above definition), because the system is tested for only 10 seconds.

The amount of ammonia released during a single test run is 0.004 lb (1.81 grams). If this amount is distributed along the entire 14,000-yard (12,796 m) test run distance, 0.00014 gram would be released in each linear meter of the run. If this amount of ammonia were diluted into 1 cubic meter of water, a concentration of 0.00014 ppm would be present at each linear meter of the test run, which is well below the water quality criterion of 4.89 ppm.

Sixty percent of the 1.81 grams of ammonia released during a test run, or 1.086 grams, would be released during a stationary test of the 'exotic' propulsion system. To reach the water quality criterion level of 4.89 ppm, this amount of ammonia would need to be diluted into approximately 222 liters or 0.222 cubic meters of water. This volume of water would be contained in two 25 foot (7.62 m) long cones, each with a base radius of 0.39 feet (0.12 m). It is likely that this amount of dilution would be quickly achieved given tidal current mixing available in the DBRC and the active dispersion of the exhaust from the underwater vehicle into a plume surrounding the vehicle.

Iron Chloride and Zirconium Oxide - The exhaust components likely present in solid (or dissolved particulate) form include carbon, iron chloride, and zirconium oxide. Elemental carbon is insoluble and unlikely to be toxic to marine organisms (Lide 1991). Iron chloride is soluble in water and toxic to marine organisms at various concentrations (Lide 1991; EPA 2000). Zirconium oxide is insoluble in water, with no toxicity data available in the comprehensive EPA ECOTOX database. However, "the inherent toxicity of zirconium compounds is low" (Lide 1991). No federal or state water quality criteria exist for iron chloride or zirconium oxide (EPA 1991; Chapter 173-201A WAC). The long test run distance (14,000 yards [12,796 m]) of the underwater vehicle using the 'exotic' propulsion system would effectively dilute these exhaust components.

The most relevant toxicity data in the EPA ECOTOX database available for iron chloride were from a study where 100 percent mortality was observed in rainbow trout (*Oncorhynchus mykiss*) for a 21 day exposure to a concentration of 3,400 µg/g or ppm iron chloride (Goettl and Davies 1977). Five percent of this level, or 170 ppm, was chosen as representative of a concentration causing low or no toxicity to rainbow trout.

The amount of iron chloride released during a single test run is 0.076 lb (34.47 grams). If this amount is distributed along the entire 14,000-yard (12,796 m) test run distance, 0.00269 gram would be released in each linear meter of the run. If this amount of iron chloride were diluted into 1 cubic meter of water, a concentration of 0.00269 ppm would be present at each linear meter of the test run, which is well below the chosen low toxicity concentration of 170 ppm.

Sixty percent of the 34.47 grams of iron chloride released during a test run, or 20.68 grams, would be released during a stationary test of the 'exotic' propulsion system. To reach the low toxicity level of 170 ppm, this amount of iron chloride would need to be diluted into approximately 121.6 liters or 0.1216 cubic meters of water. This volume of water would be contained in two 25 foot (7.62 m) long cones, each with a base radius of 0.29 feet (0.09 m). It is likely that this amount of dilution would be quickly achieved given the short duration of the test and the active dispersion of the exhaust from the underwater vehicle into a plume surrounding the vehicle.

Although no toxicity data are available for zirconium oxide, there are data for elemental zirconium toxicity to coho salmon (*Oncorhynchus kisutch*) (EPA 2000). In a study by Peterson et al. (1974), 0 percent mortality was observed at a concentration varying from 1,000 to 15,000 ppm zirconium. A concentration of 1,000 ppm was chosen as representative of zero toxicity for zirconium oxide.

The amount of zirconium oxide released during a single test run is 1.2343 lbs (559.87 grams). If this amount is distributed along the entire 14,000-yard (12,796 m) test run distance, 0.0437 gram would be released in each linear meter of the run. If this amount of zirconium oxide were diluted into 1 cubic meter of water, a concentration of 0.0437 ppm would be present at each linear meter of the test run, which is well below the zero toxicity concentration of 1,000 ppm.

Sixty percent of the 559.87 grams of zirconium oxide released during a test run, or 335.92 grams, would be released during a stationary test of the 'exotic' propulsion system. To reach the zero toxicity level of 1,000 ppm, this amount of zirconium oxide would need to be diluted into approximately 335.92 liters or 0.336 cubic meters of water. This volume of water would be contained in two 25 foot (7.62 m) long cones, each with a base radius of 0.48 feet (0.14 m). It seems likely that this amount of dilution would be quickly achieved given the short duration of the test and the active dispersion of the exhaust from the underwater vehicle into a plume surrounding the vehicle.

The recent study conducted by the Battelle Marine Sciences Laboratory indicated that water quality samples taken at four stations along the axis of the Dabob Bay test range at 1 meter below the surface and 10 meters above the bottom did not contain elevated levels of zirconium (Crecelius 2001). Washington State does not list a water quality criterion for zirconium. However, the zirconium concentrations found were four orders of magnitude below the lowest effect concentration considered toxic to aquatic organisms.

Summary - As demonstrated above, the long test run distance (14,000 yards [12,796 m]) of the underwater vehicle using the 'exotic' propulsion system will effectively dilute these exhaust components to very low levels causing no adverse effects to marine organisms. In addition, these tests would be conducted no more than 12 times per year, thus producing no cumulative or long-term effects.

Any potential adverse effects to marine organisms from infrequent stationary tests conducted with this propulsion system would be temporary in nature and limited to an area contained within two 25 foot (7.62 m) cones of water, behind the test vehicles, each with a base radius of 6.09 feet (1.86 m) at most. This volume of water would be required to dilute hydrogen cyanide, the most toxic exhaust component, to the federal and state acute water quality criterion concentration of 1 ppb. If the higher state acute criterion level for cyanide of 9.1 ppb is used, for waters south of the mouth of Admiralty Inlet, potential adverse effects would be limited to two 25 foot (7.62 m) cones of water, each with a base radius of 2.02 feet (0.61 m), at most. It seems likely that these amounts of dilution would be quickly achieved given the short duration of the test and the active dispersion of the exhaust from the underwater vehicle into a plume surrounding the vehicle. Concentrations of hydrogen cyanide and ammonia released during stationary tests probably would be below water quality criteria.

SCEPS Powered Torpedoes - Torpedoes powered by the SCEPS include the MK 50 torpedo. This propulsion system uses heat generated by an exothermic reaction. Only heat is released to the environment, as the reaction products are contained within the torpedo due to the nature of this closed system.

<u>Torpedoes Powered by Other Propulsion Systems -</u> The Navy is working on developing alternative torpedo propulsion systems that may use a variety of experimental/exotic fuels. Until prototypes are available, the final design and fuel systems cannot be fully analyzed. Current research indicates that these systems may include variations of SCEPS fuel, JP-5, rocket fuel, or other fuels. Variations of the SCEPS fuel system are generally expected to have similar effects as those of the MK 50 torpedo testing. Other fuel systems cannot be fully analyzed until the fuel components are defined. When these fuels are defined there will be individual environmental analysis done before the system is tested.

Accidental Fuel Oil and Propellant Spills

Fuel oil and hazardous substance spills can degrade water quality and be lethal or injurious to many marine organisms, depending on the amount and type of substance spilled (Malins 1977; National Research Council 1985). No intentional releases of fuel oil or torpedo propellant are integral to DBRC operations. Navy policy for all of its vessels is to eliminate or reduce the chance of spills during operations at sea. In the event of an accidental release of fuel oil or other hazardous substance during surface ship or shoreside activities of range operations, contingency plans developed by the Navy are followed that provide instructions on proper spill notification and response actions (Naval Submarine Base Bangor 1998).

The spill history in Table 6-5 indicates that during the subject time period, no significant spills of fuel oil or other hazardous substances have been associated with DBRC.

Table 6-5: Spill history at K/B Pier at SUBASE Bangor associated with DBRC Operations.

Date	Spill location	Amount	Substance
12/10/97	land	2 quarts	hydraulic fluid
12/14/98	land	½ gallon	Otto Fuel II
9/3/99	land	1 pint	antifreeze
9/20/99	land	2 quarts	hydraulic fluid

Source: ROC, Comfort, 2000

No explosive tests of torpedoes are conducted within the Dabob Bay and Hood Canal MOAs. Tests are conducted with torpedo warheads removed and replaced with test instrument packages. It is possible that an accidental torpedo propellant release may occur during a target strike (MAKERS 1999). Normally, torpedoes are programmed to avoid direct target hits, but some impact tests have been conducted with MK 50 torpedoes (powered by the SCEPS and Otto Fuel II powered torpedoes) for verification (approximately 10 per year). Normally, the torpedo propellants would not be released even in the event of an impact that fractured the outer case of the torpedo. A propellant release from a complete torpedo rupture would be considered to be a spill, initiating actions covered under Navy contingency and spill response plans.

As the probability of accidental fuel oil or torpedo propellant spills is very low (historically 1 percent) during routine range operations, it is unlikely that water quality would be significantly affected. Actions specified under Navy contingency and spill response plans would reduce the potential impacts of any such spill. The Navy has developed a "Spill Prevention Control and Countermeasures (SPCC) Oil Pollution Plan" for all its operations as required in OPNAVINST 5090.1B, Chapter 19. The SPCC plan identifies measures and practices to be taken to reduce the potential for an oil spill to occur on soils or navigable waters of the United States. The Navy has also developed an "Oil and Hazardous Substance (OHS) Release Contingency and Response Plan" to address the control, containment and cleanup of oil and hazardous substances as required by OPNAVINST 5090.1B, Chapter 10. The OHS plan identifies actions to be taken to reduce the impact of a propellant or fuel oil spill which may occur as a result of Navy operations.

Propellant Release from a Complete Rupture of an Otto Fuel II Powered Torpedo

The maximum amount of Otto Fuel II released in the event of a complete torpedo rupture during an impact test would be approximately 60 lbs (27.22 kg) as that is the maximum fuel that would be remaining in a weapon at the end of the run. There is no federal or Washington State water quality criterion for Otto Fuel II (EPA 1991; Chapter 173-201A WAC). Otto Fuel II has been found to be toxic to several marine organisms: (1) a 48-hour Median Effective Concentration (MEC_{50}) of 5.0 ppm fuel produced mortality and paralysis for pink shrimp (*Penaeus duorarum*), and (2) a 48-hour Median Lethal Concentration (MLC_{50}) of 3.2 ppm fuel was found to be lethal for spot (*Leiostomus xanthurus*; a fish species) (Continental Shelf Associates 1977).

In the event of a complete Otto Fuel II release from a ruptured torpedo, concentrations of Otto Fuel II would be diluted and dispersed by oceanic mixing processes to non-toxic concentrations. For this analysis, 10 percent of the MLC_{50} for spot of 3.2 ppm , or 0.32 ppm, is used as representative of low or no toxicity. To reach this concentration, the 27.22 kg (or 22.09 liters) of Otto Fuel II released would need to be diluted into approximately 69,034,375 liters or 69,034 cubic meters. This volume of water would be contained in a sphere with a radius of 83.48 feet (25.45 m). It seems likely that this level of dilution would be achieved relatively quickly, given ambient mixing and dispersion. However, a release of Otto Fuel II would cause temporary, localized toxicity effects to marine organisms prior to dilution to non-toxic levels.

SCEPS Propellant Release from a Complete Torpedo Rupture

The maximum amount of SCEPS propellant chemicals released in the event of a complete MK 50 torpedo rupture would be approximately 10 pounds (4.5

kg) of lithium and 10 lbs (4.5 kg) of sulfur hexafluoride (MAKERS 1999). Possible reaction byproducts released (in lower amounts) in the case of a complete SCEPS torpedo rupture include potassium chloride, lithium carbide, lithium carbonate, lithium chloride, lithium fluoride, lithium hydride, lithium hydroxide, and lithium sulfide.

While no EPA or Washington State water quality criteria exist for lithium, sulfur hexafluoride, or any of the reaction byproducts, lithium, potassium chloride, lithium chloride, and lithium carbonate can be toxic to aquatic and marine organisms at certain concentrations, based on data in the comprehensive EPA ECOTOX aquatic toxicity database (EPA 1999). No toxicity data are available in the database for the other reaction byproducts.

Lithium is slightly toxic to aquatic organisms, with a 96 hour LC_{50} (lethal concentration resulting in 50 percent mortality of test organisms) in fathead minnows (*Pimephales promelas*) of 42 mg/L and a No Observed Effect Concentration (NOEC) of 13 mg/L (Long et al. 1998). No aquatic toxicity information was located for sulfur hexafluoride, but this compound is widely used as a tracer chemical in oceanographic and atmospheric experiments (King and Saltzman 1995). Lithium carbonate has been found to be toxic to mummichog (*Fundulus heteroclitus*; a fish species) at a 96-hour LC_{50} of 39 mg/L (Dorfman 1977). Lithium chloride is chronically toxic to fathead minnow larvae, with a 26-day LC_{50} of 8.7 mg/L and a NOEC of 1.2 mg/L (Long et al. 1998).

In the event of a complete SCEPS propellant release, concentrations of these substances would quickly be diluted and dispersed by oceanic mixing processes to non-toxic concentrations. If the NOEC of 13 mg/L of lithium for fathead minnows is accepted as representative of the sensitivity of marine organisms in Dabob Bay, the maximum accidental release of 10 lbs (4.5 kg) of lithium would need to be diluted into a volume of seawater which could be contained in a sphere of water with a radius of 14.1 feet (4.3 m) to achieve the NOEC concentration. Tidal and wind-induced currents and water movements in Dabob Bay and northern Hood Canal should provide this level of dilution in a short time period, likely within several hours. It is unlikely that any salmonids would be present in the immediate vicinity and at the exact time of an accidental rupture. If present, they would be very unlikely to remain in the vicinity of the spilled chemicals long enough for any toxic effects to occur (i.e., 96 hours or 26 days). Such an accidental release would cause a short-term toxic hazard to marine life in the immediate vicinity prior to dilution to non-toxic levels.

The recent study conducted by the Battelle Marine Sciences Laboratory indicated that water quality samples taken at four stations along the axis of the Dabob Bay test range at 1 meter below the surface and 10 meters above the bottom did not contain elevated levels of lithium (Crecelius 2001). Washington State does not list a water quality criterion for lithium. However, the lithium concentrations found are comparable to those occurring naturally in the ocean.

Increased Turbidity from Seabed Disturbance

Temporary increases in water column turbidity arising from seabed disturbance can occur during the retrieval of torpedoes and other devices from the sea bottom as part of range operations. Retrievals of torpedoes or other devices from the sea bottom are infrequent, occurring less than 14 times per year (MAKERS 1999). In about half of these retrievals (or about 7 times a year), torpedoes may embed themselves in the soft bottom sediments, requiring that they be washed out using pressure-washing systems to clear away the soft bottom sediments. The majority of embedded torpedo recoveries would disturb the surface of the seabed within a circular area with an approximate radius of 15 feet (4.6 m), or 707 square feet (66 m^2). Within this area, a volume of sediments would be disturbed approximating a hemisphere in shape, with a 15-foot (4.6 m) radius, or 524 cubic yards (400 m^3) of sediment. Torpedoes have rarely been known to bury themselves as deep as 28 feet (8.5 m) measured to the tail, although this represents the extreme, happening approximately once every five years.

The sediments disturbed during these recovery operations would quickly settle back to the bottom. Observations of torpedo recoveries in Dabob Bay indicate that it takes approximately 2 hours for disturbed sediment to completely settle to the bottom. This is consistent with Bowen (1976), in a computer modeling study of dredged material disposal, who estimated that 77 percent of a 310 cubic yard (237 m^3) volume of sediments dropped in 50 feet (15.2 m) of water would settle to the bottom within 25 minutes. Similar settlement volume percentages were obtained ranging from 82 to 78 percent for sediment volumes from 4.9 to 2,479 cubic yards (3.7 to 1,895 m^3). Such an event would temporarily exceed turbidity standards around the excavator, but this is a minor and temporary adverse effect.

Heavy Metal Leaching into the Water Column

Potentially, heavy metals could leach into the water column from lead anchors, lead dropper weights (half-coated with cadmium plating), aluminum alloy parachute weights copper core guidance wire, and/or electronic countermeasure and sonobuoy devices with steel housings used in the course of DBRC operations. As more environmentally friendly techniques and substances become technologically feasible and available, the Navy is committed to moving towards the use of new technologies on a routine basis. These anchors, weights, guidance wires, and devices will all mostly sink into the soft sediments at the bottom of Dabob Bay or Hood Canal. Lead, copper, cadmium, and aluminum can be toxic to many marine organisms in certain forms and at certain concentrations (PSEP 1991). These potential sources of contaminants are very unlikely to significantly affect water quality in Dabob Bay or northern Hood Canal, with the possible exception of lead slowly released from the top of lost diamond-shaped anchor exposed to seawater above the sediment surface.

Diamond-shaped 6,000-lb (2,700 kg) lead anchors are used for temporary anchoring of tracking and other devices during tests. The top of a lost diamond-shaped lead anchor sunk into the sediments would be subject to seawater corrosion over time. Some of these anchors have been lost in the past, but measures have been implemented to reduce or eliminate these losses. Occurrences of lost anchors are rare (MAKERS 1999). The corrosion rate of lead in seawater ranges from 0.3 to 1.2 mils per year (0.00762 to 0.0305 mm per year), or an average of 0.75 mils per year (0.0019 mm per year) (Kennish 1989). This rate of corrosion acting on a 3,329 square inch (2.15 m^2) anchor top, would lead to a potential loss of 0.46 kg of lead per year per unrecovered anchor unit.

To reach the WDOE acute water quality criterion for lead of 210 μg/L, 0.46 kg of lead would have to be diluted into 2,190,476 liters of water, or 2,190 cubic meters of water. This volume of water would be contained in a half-sphere with a radius of 33.19 feet (10.15 m) centered above the anchor top. Because any lead would be released slowly and continuously into the water over an entire year, it is likely that the small amounts of lead entering the water per hour would be adequately diluted on an ongoing basis, without building up concentrations toxic to marine organisms. While the lead will not be available to organisms in the water column, sediments directly adjacent to the source will probably exceed SMSs.

In addition, up to 40 small 36 lb (16.3 kg) lead "dropper weights" are expected to be jettisoned each year in the course of the MK 46 testing program falling to the bottom and sinking into the sediment. These weights are half-coated with cadmium. There is a program to eventually replace the current lightweight torpedoes with a more advanced torpedo that will not use the lead droppers. Thus over the course of the next 10 years, it is expected that the amount of lead droppers will decline. Small aluminum (6 lb [2.7 kg]) alloy weights are jettisoned from torpedo parachutes in some range tests, along with nylon parachutes (4.3 square yards [3.6 m^2]) and harnesses, about 10 times per year. These weights will also sink into the sediments. Torpedo testing involves the use of insulated copper cored guidance wire trailed behind the torpedo. This guidance wire is then left to sink to the sea bottom after the conclusion of the test. In addition, approximately 50 electronic countermeasure devices (3-5 inches [7.6 to 12.7 cm] in diameter and 2-6 ft [0.6 to 1.2 m] long) will be deployed during DBRC operations each year, which will fall to the bottom and sink into the sediments. These devices have steel housings and contain batteries with heavy metals such as zinc, copper, cadmium, and lead. In addition about 10 acoustic listening devices known as sonobuoys are estimated to be lost each year. These devices with steel housing and the same batteries will also sink into the sediments.

Materials dropped to the bottom are expected to settle into and below the mostly anaerobic surface sediments and completely anaerobic sub-surface sediments at the bottom of Dabob Bay. If materials happen to fall onto the small percentage of the bay bottom with aerobic surface sediments, they will likely settle below the surface and imbed into anaerobic sub-surface sediments.

Any leached lead or other heavy metals from these sources will likely be adsorbed onto anaerobic bottom sediments and would not be released into the water column (Song and Muller 1999; PSEP 1991; Cowie and Hedges 1992; D'Itri 1990). Wong et al. (1978) stated that only waterborne, soluble lead is toxic to aquatic biota. Thus, no adverse impacts to water quality from heavy metals would result from anchors, weights, guidance wire, and other devices.

The recent study conducted by the Battelle Marine Sciences Laboratory indicated that water quality samples taken at four stations along the axis of the Dabob Bay test range at 1 meter below the surface and 10 meters above the bottom did not contain elevated levels of cadmium, copper, lead or zinc (Crecelius 2001). Water quality samples taken 10 meters above the bottom would reflect metal concentrations leached out into the water column from metal objects on the bay bottom, if this process was occurring to any significant degree. Analysis of the seawater samples indicated that heavy metal analytes were present at low levels comparable to background levels present in non-urban portions of Puget Sound. The four metals (Cd, Cu, Pb, and Zn) had concentrations well below listed Washington State water quality criteria.

These potential sources of water and sediment quality degradation are very unlikely to adversely affect salmonids of any life stage. This is due primarily to the fact that any potential heavy metal leaching would most likely take place in the deep waters of Dabob Bay and Hood Canal, far below depths utilized by salmonids.

6.2.2 Potential Acoustic/Noise Effects

Acoustic emissions produced during ongoing and future operations of the DBRC are summarized in Table 6-1, and can be categorized as: (1) low frequency emissions; (2) infrequently used low frequency sonar emissions utilized in submarine and other operations, and in countermeasure tests; and (3) high frequency acoustic emissions used in tracking torpedoes and other underwater vehicles, and in countermeasure tests (NUWC Division Keyport 1999). A fourth category of acoustic emissions is from the TOSS, with sound frequencies of 100 Hz to 10 kHz at intensities of 170 dB.

Acoustic emissions from large boats and submarines, primarily engine noise, are at frequencies of 50–150 Hz at intensities of 160–170 dB (MAKERS 1999). Acoustic emissions from small boats and torpedoes are at frequencies of 100-1000 Hz at intensities of 150-160 dB.

Aside from engine noise, underwater sounds of low frequencies below 5,000 Hz (5 kHz) are only infrequently emitted during range operations during sonar usage by surface ships, aircraft, submarines and in countermeasure tests (ROC, NUWC, 1999b). Fleet sonar is estimated to be used on the DBRC approximately 2 times per year (ROC, NUWC, 2000b). Sounds of 100 Hz are used approximately 2 times a year in range operations.

The primary high frequency sound emissions used in range operations are from tracking pingers on torpedoes and other underwater vehicles that emit downward focused 75 kHz Phase Shift Keyed (PSK) signals (5.2 millisecond pulse duration) to enable tracking of the torpedo or other vehicle by underwater hydrophones on the bottom of Dabob Bay (MAKERS 1999; NUWC Division Keyport 1999). Spaced Frequency Shift Keyed (SFSK) tracking signals are also used with frequencies of 35, 43, and 49 kHz (567 millisecond pulse duration). Torpedoes and other underwater vehicles also may utilize 0.05 to 350 kHz acoustic emissions during operations.

Most of the acoustic emissions used in ongoing and future operations of the DBRC are at intensities below the 180 dB level defined by the Department of the Navy (1999) as the start of potential injury to the hearing abilities of fish. Based on transmission loss formulae available for Dabob Bay, sound intensity for sources greater than 180 dB would be attenuated to the 180 dB level at: (1) an approximate distance of 18 m (20 yards) or closer for tracking sonar (194 dB), other sonar transmissions (225 dB), and Aid to Navigation equipment (210 dB); and (2) an approximate distance of 24 m (26 yards) for Fleet sonar (ROC, NUWC, 2000a). Using the 180 dB threshold, no harm would result to fish outside the distances described above (18 and 24 m). In the unlikely case that fish were within these distances, they would be very unlikely to remain the length of time (i.e., more than several hours) to sustain any injury. In addition, the fish would have to be exposed to continuous sound above 180 dB for at least several hours for injury to occur, unlike the pulsed sound emitted by these four sources. Most of the acoustic emissions in DBRC operations are not continuous, except for engine noise below 180 dB. Thus, the potential effects of these emissions would be limited to the production of avoidance reactions in fish which is a temporary behavior leaving no permanent injury to the fish and which only occurs in certain circumstances, as discussed below in more detail.

Sound Perception by Fish and Salmonids

In general, fish perceive underwater sounds in the frequency range of 50 to 2,000 Hz, with peak sensitivities below 800 Hz (Popper and Carlson 1998; Department of the Navy 1999). However, there are a number of taxonomic groups of fish, called hearing specialists, that have enhanced hearing abilities due to the mechanical coupling of the otolith organ (or fish ear) with the swim bladder (an air-filled sac which is used by some fish for buoyancy compensation) (Popper and Fay 1993). In some fish, this connection is made by a series of bones called Weberian ossicles. Other hearing specialist fish, such as the Clupeidae, have connections between the otolith organ, swim bladder, and lateral line system via a structure called prootic auditory bullae (Carlson 1994). Fish without swim bladders or without a connection between the otolith organ and swim bladder do not have enhanced hearing abilities.

Permanent injury to fish from acoustic emissions has been shown only for high intensity sounds of long duration on the order of several hours. Hastings et al. (1996) found damage to sensory hair cells in the otoliths of the oscar (*Astronotus ocellatus*) with sounds of 300 Hz at intensities of 180 dB for four hours. Cox et al. (1986, 1987) also found sensory hair cell damage in goldfish (*Carassius auratus*) exposed to pure sound tones at 250 and 500 Hz at intensities of 204 and 197 dB.

Limited injury to sensory hair cells in the otolith organs of fish from acoustic emission has been show only after exposure to continuous high intensity (180 dB) sounds (at 300 Hz) lasting 4 hours or longer (Hastings et al. 1996). Cox et al. (1986, 1987) also found some sensory hair cell damage in goldfish (*Carassius auratus*) exposed to pure sound tones at 250 and 500 Hz at intensities of 204 and 197 dB.

Hastings et al. (1996) concluded that extensive injury to the hearing ability of fish would occur at: (1) 220 to 240 dB for non-hearing specialists, and (2) approximately 50 dB less for hearing specialists. The Department of the Navy (1999) concluded from these findings that fish would: (1) have to be within a ≥180 dB sound field from a source to possibly incur non-serious injury, and (2) well within a sound field ≥180 dB at the onset of transmission (i.e., co-located with the sound source) for serious injury to occur. In addition, they concluded that there was a low probability that fish would be within a ≥180 dB sound field long enough (i.e., several to many hours) to cause adverse effects.

Salmonidae

Fish in the family Salmonidae include salmon, trout, and char. Although Salmonidae do possess swimbladders, they are not “hearing specialists,” as they lack the mechanical coupling via Weberian ossicles between the otolith organ and the swimbladder (Hawkins and Johnstone 1978).

Atlantic salmon (*Salmo salar*) have been found to perceive underwater sound up to 380 Hz. However, other studies have shown that sensitivity to sound in Atlantic salmon drops off sharply above 150 Hz (Knudsen et al. 1992, 1994). Facey et al. (1977) tested the response of Atlantic salmon parr to pulsed ultrasonic transmitters transmitting at: (1) 75 KHz (258 and 194 pulses per minute), (2) 75 kHz (180 pulses per minute), (3) 75 kHz (200 pulses per minute), and (4) 55 kHz (100 pulses per minute). They found that the salmon were unable to detect any of these transmissions.

Rainbow trout (*O. mykiss*) have been found to be sensitive to sounds from 25 to 800 Hz (Abbott 1973). Juvenile chinook salmon have been shown to exhibit avoidance responses to low frequency sound up to 280 Hz, with no response to higher frequencies (VanDerwalker 1967 as cited in Carlson 1994). The strongest response was found for sounds between 30 and 150 Hz. The salmon were found to respond to low frequency sounds, but only at very short ranges – within distances of 2 feet (0.61 m) or less from the sound source, even though the sounds were at levels up to 156 dB (re: μPa).

Carlson (1994), in a review of 40 years of studies concerning the use of underwater sound to deter salmonids from hazardous areas at hydroelectric dams and other facilities, concluded that salmonids were: (1) only able to respond to low frequency sound, and (2) only able to react to sound sources within a few meters of the source. He speculated that the reason that underwater sound had no effect on salmonids at distances greater than a few meters from the source is that they are reacting to water particle motion / acceleration, not sound pressures as such. Detectable particle motion is only produced within very short distances of a sound source, although sound pressure waves travel much farther.

Potential Acoustic Effects on Salmonids of Dabob Bay and Hood Canal MOA Operations

Acoustic emissions used in ongoing and future Dabob Bay and Hood Canal MOA operations are unlikely to adversely affect salmonids of any life stage in the waters of the MOAs. This is due to: (1) salmonids only perceive and elicit avoidance responses to low frequency sounds up to approximately 800 Hz, with greatest sensitivity to sounds below 150 Hz. Even if salmonids are close enough to perceive these sounds (within a few meters), they would react with avoidance behavior, with no permanent harm inflicted; and (2) salmonids are unable to perceive high frequency sounds such as the 75 kHz tracking pingers most often used in MOA operations.

Surface Ship, Submarine, and Torpedo Engine Noises

Several researchers have shown that fish such as herring react to low frequency vessel noise at close to moderate ranges (within 82 to 3,280 feet [25 to 1,000 m]) with temporary avoidance responses (Mitson 1993; Soria et al. 1996; Misund et al. 1996). As stated above, salmonids react to sounds only within a few meters of the source (Carlson 1994). It is possible that salmonids in Dabob Bay or Hood Canal could find themselves in range of these sound sources. However, even if these sources are perceived, the fish would react by swimming away from the sound source, with no permanent harm inflicted.

In addition, low frequency engine noises emitted by surface ships during range operations are the same or similar to those emitted by surface ship operations in all parts of Puget Sound. In fact, surface ship operations in Dabob Bay are less intense than in other parts of Puget Sound due to its remote location and low level of urban development, producing a very quiet acoustic environment (MAKERS 1999). This is one of the reasons Dabob Bay is used for torpedo testing operations.

Low Frequency Sonar Emissions

Perceivable low frequency sonar emitted from submarines is likely to be in waters deeper than salmonids frequent. However, it is possible that salmonid fish in Dabob Bay or Hood Canal could find themselves within close range of low frequency sonar emitted from surface ships or countermeasure devices. However, even if these low-frequency sonar sources are perceived, the fish would react by swimming away from the sound source with no permanent harm inflicted.

High Frequency Sonar Emissions

High frequency ultrasound emissions, such as those used for tracking in ongoing and future DBRC operations, are unlikely to adversely affect salmonids of any life stage in the waters of the MOAs. This is due to the following: (1) it is very unlikely that salmonids would happen to be close to high frequency sound sources used in the MOAs, as they would be emitted by moving torpedoes and other devices in the open waters of Dabob Bay and northern Hood Canal; and (2) salmonids are unable to perceive the high frequency sounds used in range operations.

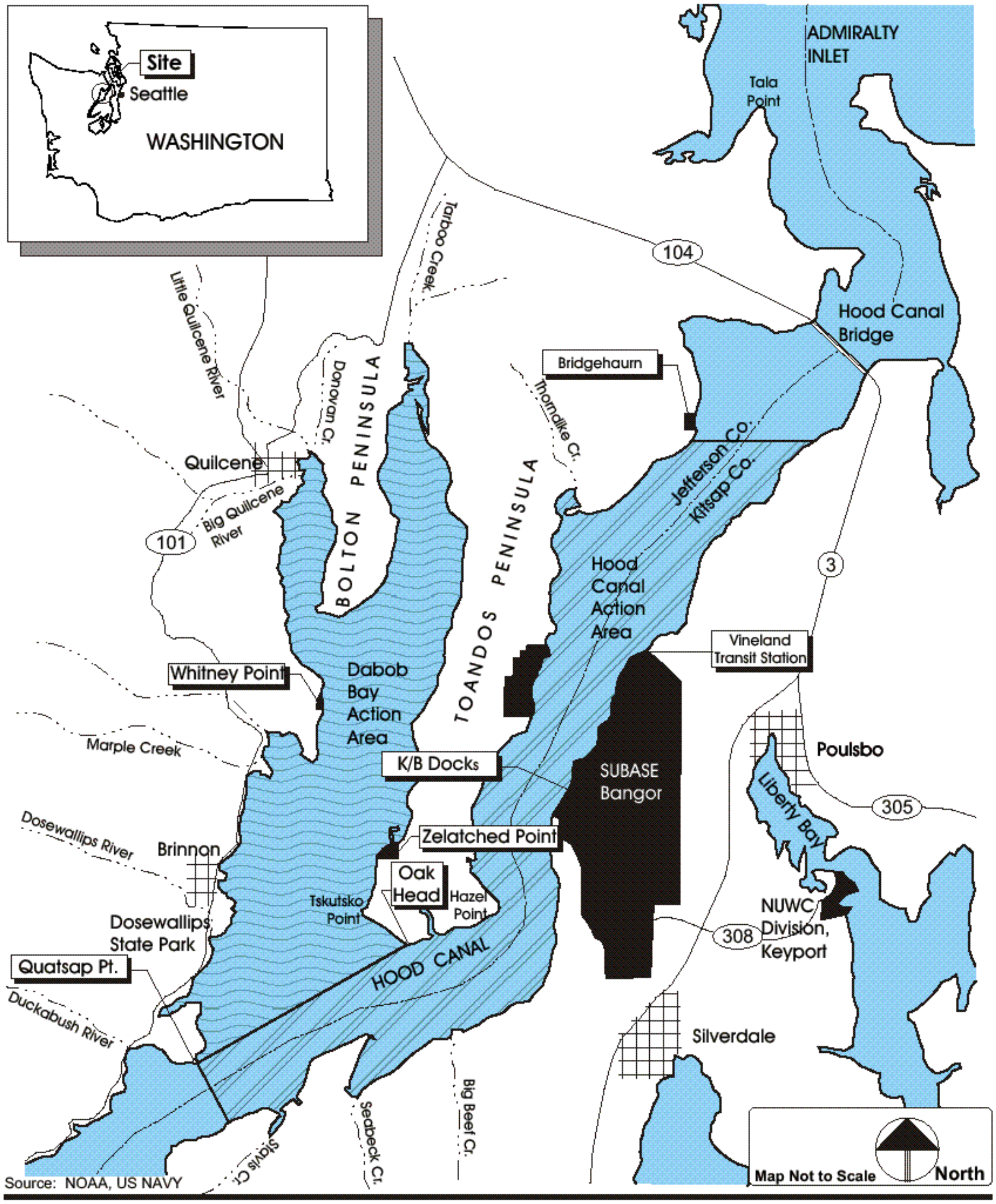
6.2.3 Analysis of Project Operations Effects on Salmonid Habitat in the DBRC

The potential effects of ongoing and future operations of the DBRC on the three species of salmonids listed as threatened under the ESA (Hood Canal summer-run chum salmon, Puget Sound chinook salmon, and Coastal/Puget Sound bull trout), evaluated in previous sections, are analyzed in this section using an approach developed in NMFS (1996). This approach follows these steps:

1. An action area is defined, which is the geographic area in which project effects could be potentially experienced by species listed under the ESA;
2. A matrix of pathways (water quality, physical habitat elements, and biological habitat elements) and indicators (various elements of the pathway categories) is developed for salmonid estuarine habitat present in the action area. This matrix characterizes three levels of habitat function: properly functioning, at risk, and not properly functioning;
3. Environmental baseline conditions of salmonid estuarine habitat present in the action area are characterized by level of habitat function using the above matrix in an indicators checklist;
4. Project effects on salmonid estuarine habitat present in the action area are characterized in an indicators checklist as having an effect to restore, maintain, or degrade existing environmental baseline conditions for each habitat indicator;
5. Based on the matrix and the two checklists, an effect determination is made based on a dichotomous key and definitions in NMFS (1996).

6.2.3.1 Action Areas

The action areas for purposes of this Biological Assessment consist of the waters comprising, immediately adjacent to, and connecting the three Navy MOAs in Dabob Bay and northern Hood Canal. Specifically, the two action areas consist of: (1) all of the waters of Dabob Bay including the Dabob Bay MOA, south to a line drawn from Oak Head (at the tip of the Toandos Peninsula) across to Quatsap Point, extending the southern boundary line of the MOA across the mouth of the bay; and (2) the waters of a portion of northern Hood Canal including: (a) the waters of Hood Canal from a line extending the northern boundary line of the two Hood Canal MOAs across Hood Canal at 47^{o} 50' N latitude south to a line extending the southern boundary line of the two Hood Canal MOAs across Hood Canal at 47^{o} 42' N latitude; and (b) the waters that connect the MOAs, from a line across Hood Canal at 47^{o} 42' N latitude to a line drawn perpendicularly across Hood Canal starting at Quatsap Point. These two areas are referred to below as the Dabob Bay and northern Hood Canal action areas (Figure 6-1).



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NUWC Division Keyport

Dabob Bay/Hood Canal Action Areas

Figure 6-1

6.2.3.2 Matrix of Pathways and Indicators for Salmonid Estuarine Habitat

The matrix of pathways and indicators for salmonid estuarine habitat used in this analysis was developed by SAIC (1999) for a Biological Assessment of homeporting and maintenance berth improvements for the stationing of Nimitz-class aircraft carriers at the Bremerton Naval Complex in Bremerton. This matrix was based on the features of a matrix for freshwater salmonid habitats found in NMFS (1996). It should also be noted that a freshwater habitat matrix has also been developed for bull trout by the USFWS (1998), which is also based on NMFS (1996). As both of these matrices are for freshwater salmonid habitats and the project effects of the DBRC are exclusively estuarine, the SAIC (1999) matrix is used for this analysis. This matrix is reproduced in Table 6-6. The reasoning for each of the criteria levels set in the matrix for the various habitat indicators is provided in SAIC (1999). This matrix and the indicators checklists discussed below apply to the estuarine habitat of all three species of salmonids covered by this Biological Assessment.

Acoustic baseline conditions and project effects on these conditions due to acoustic emissions generated during DBRC operations have not been added to the matrix or the indicators checklists, as they are complex and transitory phenomenon not easily categorized into the structure of the matrix and checklists. Acoustic emissions must be described by frequency, intensity, signal duration, attenuation with distance, and usage, all of which would be difficult to fit into the format of this analysis. The potential effects of these emissions on the three species of threatened salmonids have been evaluated in detail in previous sections.

6.2.3.3 Indicators Checklist for Baseline Conditions in the Action Area

Table 6-7 contains the indicators checklists for baseline conditions in the Dabob Bay and northern Hood Canal MOAs. The reasons for the indicator ratings shown in the checklist are explained in detail below.

Water Quality

Turbidity was not measured at the Washington Department of Ecology (WDOE) ambient monitoring Station HCB002 in Dabob Bay or at Station HCB006 in northern Hood Canal (EDAW 2000). No other turbidity data for this area were located. Given that these areas are relatively remote and are not in enclosed urban bay areas where extensive dredging or stormwater runoff from development and other watershed activities can lead to increased turbidity, it was judged that the turbidity indicator was likely to be properly functioning in both action areas.

Table 6-6: Matrix of Pathways and Indicators for Salmon Estuarine Habitat.

Pathway	Indicators	Properly Functioning	At Risk	Not Properly Functioning
Water Quality	Turbidity	Low	Moderate (> 300 mg/l)	High (> 4000 mg/l)
	Dissolved Oxygen	> 6.0 mg/l	6.0 – 4.25 mg/l	< 4.25 mg/l
	Water Contamination / Nutrients	No exceedance of WQC; no CWA 303(d) waters	Single WQC exceedance	Multiple WQC exceedances; 303(d) waters present
	Sediment Contamination	No SQS exceedances	Multiple SQS exceedances	Multiple CSL exceedances
Physical Habitat Elements	Substrate / Armoring	Natural conditions, consisting predominantly of mud, sand, and gravel; no armoring	Some armoring of the shoreline with riprap or quaywalls	Extensive armoring of the shoreline eliminating sand, mud, and gravel areas
	Depth / Slope	• Juveniles: shallow, gently sloping nearshore areas (< 3 m depth is optimal) • Adults: prefer deeper water habitat	Some bank steepening and loss of shallow water habitat	Steep banks with limited shallow water habitat (primarily > 3 m depth)
	Tideland Condition / Filling of Tidelands	Extensive intertidal area exists with limited historical tidal filling	Some filling of tidelands has occurred	Large intertidal areas have been filled; limited remaining tidelands
	Marsh Prevalence/ Complexity	Natural conditions; sufficient marsh exists to provide habitat for juvenile salmon	Some loss of marsh habitat has occurred	Marshes absent or inadequate as salmon habitat
	Refugia (important habitat for sensitive aquatic sps.)	Habitat refugia exist and are adequately buffered; existing refugia are sufficient in size, number, and connectivity to maintain viable populations	Natural refugia exist but are not adequately buffered or are insufficient in size, number, or connectivity	Adequate habitat refugia do not exist
	Physical Barriers (bridges, seawalls, piers, floating structures, culverts)	Natural conditions; any man-made barriers allow proper salmon migration	Man-made barriers disrupt salmon migration	Extensive barriers restrict and/or block salmon migration
	Current Patterns	Natural conditions	Alteration from natural resulting in effects on water quality and salmon habitat	Significant alteration resulting in substantial adverse effects on water quality and/or biological resources
	Salt / Freshwater Mixing Patterns and Locations	Natural conditions	Alteration from natural resulting in changes in mixing locations and/or the extent of the mixing zone	Significant alteration resulting in substantial changes in mixing zones; estuarine area and natural hydrology lost

Table 6-6: Matrix of Pathways and Indicators for Salmon Estuarine Habitat.

Pathway	Indicators	Properly Functioning	At Risk	Not Properly Functioning
Biological Habitat Elements	Salmon Prey Availability (benthic infauna and epibenthic communities	High benthic infaunal abundance and diversity; complex natural community	Alteration in benthic infaunal abundance, diversity, or species composition	Low benthic infaunal abundance and diversity resulting in decreased salmon prey availability
	Forage Fish Community	Natural community consisting of herring, sand lance, surf smelt	Alteration of natural community	Limited abundance and/or diversity decreasing prey availability
	Aquatic Vegetation	Natural conditions	Alteration of natural conditions	Extensive alteration from natural
	Exotic Species	No exotic species present	Some exotic species present	Exotic species present affecting salmon prey and/or predators

Source: SAIC 1999.

Notes: WQC = water quality criteria (Chapter 173-201a WAC); CWA = Clean Water Act; SQS = Sediment Quality Standards (Chapter 173-204 WAC); CSL = Cleanup Screening Levels (Chapter 173-204 WAC).

Table 6-7: Indicators Checklist for Baseline Conditions in the Dabob Bay and Northern Hood Canal Action Areas.

Pathways Indicators	Environmental Baseline		
	Properly Functioning	At Risk	Not Properly Functioning
Water Quality			
Turbidity	X (both areas)		
Dissolved Oxygen	X (Dabob Bay)	X (N. Hood Canal)	
Water contamination / Nutrients		X (Dabob Bay)	X (N. Hood Canal)
Sediment Contamination	X (Dabob Bay)		X (N. Hood Canal)
Physical Habitat Elements			
Substrate / Armoring		X (both areas)	
Depth / Slope		X (both areas)	
Tideland Condition /Filling of Tidelands			
Marsh Prevalence / Complexity	X (Dabob Bay)	X (N. Hood Canal)	
Refugia	X (Dabob Bay)	X (N. Hood Canal)	
Physical Barriers (bridges, seawalls, piers, floating structures)	X (Dabob Bay)	X (N. Hood Canal)	
Current Patterns	X (both areas)		
Salt / Fresh Water Mixing Patterns and Locations	X (both areas)		
Biological Habitat Elements			
Benthic Prey Availability	X (both areas for chinook salmon)	X (both areas for summer-run chum salmon)	
Forage Fish Prey Availability	X (both areas)		
Aquatic Vegetation	X (both areas		
Exotic Species		X (both areas)	

Data from Stations HCB002 and HCB006 indicated that dissolved oxygen (DO) was in the normal range in Dabob Bay but was depressed (down to 4.6 mg/L) in northern Hood Canal due to natural conditions. Thus, the dissolved oxygen indicator was rated properly functioning in Dabob Bay and at risk in the northern Hood Canal action area.

Dabob Bay was placed on the proposed 1998 303(d) Impaired and Threatened Waters list by WDOE (1998) for high fecal coliform levels in Quilcene Bay that exceeded the WDOE water quality criterion for this parameter (Chapter 173-201a WAC). These high levels also resulted in a prohibition on commercial shellfish harvest in northern Quilcene Bay (Washington Department of Health [WDOH] 1998). The source for these elevated levels was given as rural non-point. Therefore, the Dabob Bay action area was rated at risk for the water contamination indicator for this single water quality criteria exceedance.

Water quality samples collected by the Battelle MSL on the surface and off the bottom of Dabob Bay on the DBRC test range indicate that analyzed metals (Cd, Cu, Pb, Zn, Li, and Zr) are not present at elevated levels (Crecelius 2001). Metal concentrations are comparable to background levels present in non-urban portions of Puget Sound, and are either well below Washington State water quality criteria (Cd, Cu, Pb and Zn), at naturally occurring levels (Li) or are well below levels considered toxic to aquatic organisms (Zr).

Northern Hood Canal, which includes the two Hood Canal MOAs used by the DBRC was placed on the 1998 303(d) list for multiple exceedances of WDOE's Sediment Quality Standards (SQS) (Chapter 173-204 WAC) at a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Superfund site at SUBASE Bangor. Therefore, the northern Hood Canal action area was rated not properly functioning for both the water contamination and sediment contamination indicators, based on the matrix criteria, although the rest of this area would probably be rated properly functioning.

As explained in the Marine Sediments section of the EA for this project (EDAW 2000), given that sediments collected from Dabob Bay had very low percentages of Total Organic Carbon (TOC), comparison of sediment chemistry data to SQS criteria may be inappropriate. These data did not exceed criteria when compared to Dredged Material Management Program (DMMP) screening levels (SL). Therefore, the Dabob Bay action area was rated as properly functioning in regard to the sediment contamination indicator.

Physical Habitat Elements

Substrate / armoring conditions have not been surveyed specifically in Dabob Bay and northern Hood Canal. In a survey based on random sampling of shoreline areas, the Washington Department of Natural Resources (WDNR) estimated that 32% of the shoreline of Hood Canal as a whole had been modified including armoring with seawalls, riprap, and similar material (Berry 1997 as reported in Broadhurst 1998). Based on the density and small size of shoreline real estate parcels present, the western and northern shorelines of Dabob Bay and the eastern shoreline of northern Hood Canal appear to be extensively developed (Jefferson County 2000). The western and eastern shorelines of the Toandos Peninsula do not appear to be densely developed, except for the southern tip of the peninsula. Based on this visual, non-quantitative assessment, the figure of 32% shoreline modification for the whole of Hood Canal also seems reasonable for Dabob Bay and northern Hood Canal. Therefore, the substrate / armoring and depth / slope indicators were rated as at risk for both action areas.

Based on nautical charts of the areas (NOAA 1997 and 1998), there does not appear to be extensive tideland filling in Dabob Bay, except for some small, likely historical, diked areas in the far northern portion of Quilcene Bay. There has been extensive filling / shoreline modification at the Bangor SUBASE in northern Hood Canal. Therefore, the tideland condition indicator was rated as properly functioning for Dabob Bay and at risk for the northern Hood Canal action area.

In Dabob Bay, there are extensive shallow intertidal areas in northern Quilcene and Tarboo bays, and at the mouth of the Dosewallips River (WDFW 1999b; NOAA 1997 and 1998). These areas consist of mudflats, saltmarshes, and eelgrass beds (Thom and Hallum 1990). At the head of Tarboo Bay, WDNR maintains a 187-acre (76 ha) Natural Area Preserve protecting intertidal saltmarshes and a coastal spit ecosystem (Murray 1998). In addition, WDNR owns roughly 30 to 40% of the tidelands in Dabob Bay, including those at Dosewallips State Park (WDNR 1990). These areas do not appear to be altered in any significant ways, and many are protected from development. Therefore, the Dabob Bay action area was rated as properly functioning for the marsh prevalence and refugia indicators.

In the northern Hood Canal action area, there are less extensive shallow intertidal areas than in Dabob Bay (WDFW 1999b; NOAA 1997 and 1998). The largest such areas are in Thorndyke, Seabeck, and Stavis bays and at the mouths of Big Beef and Anderson creeks. WDNR only owns roughly 10% of the tidelands in the northern Hood Canal action area, mostly adjacent to the Naval Reservation property on the eastern side of the Toandos Peninsula across from SUBASE Bangor (WDNR 1990). In addition, there have been extensive shoreline modifications at SUBASE Bangor. For these reasons, the northern Hood Canal action area was rated at risk for the marsh prevalence and refugia indicators.

In Dabob Bay, there are few docks, piers, or other man-made barriers shown on nautical charts for the area (NOAA 1997 and 1998). Those that exist are small and likely would not disrupt salmonid migration along the shoreline. Therefore, the physical barrier indicator was rated properly functioning for the

Dabob Bay action area. In the northern Hood Canal action area, there are more numerous docks and piers, especially at SUBASE Bangor, where there are large, wide piers extending out in the water. There is some evidence that these piers may have an effect on migrating juvenile chum salmon, causing the fish to move offshore to go around the structures (Salo et al. 1980). Therefore, the physical barrier indicator was rated at risk in the northern Hood Canal action area.

Current patterns and salt / freshwater mixing patterns and locations in the Dabob Bay and northern Hood Canal action areas have not been significantly altered by human activity or structures. Therefore, these indicators were rated as properly functioning in both action areas.

Biological Habitat Elements

There is evidence of low availability of epibenthic salmonid prey organisms present in Hood Canal at the time (February and March) of out-migration by juvenile Hood Canal summer-run chum salmon (Simenstad and Kinney 1978; Tynan 1997). This may lead to the rapid out-migration rate and short estuarine residence time observed for this run of chum salmon. Juvenile salmon, which enter estuarine areas later in the spring with peak out-migration in April through June, have longer estuarine residence times and take longer to complete their out-migration from Hood Canal, as there are more abundant food resources available. Therefore, the salmon prey availability indicator for both the Dabob Bay and northern Hood Canal action areas was rated at risk for Hood Canal summer-run chum salmon, and properly functioning for Puget Sound chinook salmon. There is no evidence available for the timing of South Fork Skokomish River anadromous bull trout out-migration, if they are present in Hood Canal. Therefore, a salmon prey availability rating was not made for bull trout.

Herring, surf smelt, and sand lance, forage fish for salmon and other marine animals, are all present in the waters of both the Dabob Bay and northern Hood Canal action areas (WDFW 1995; WDFW 1997b). The status of the Quilcene Bay herring stock, which spawns on eelgrass beds in Quilcene Bay and Jackson Cove in Dabob Bay, is unknown due to inadequate data (WDFW 1995). The Port Gamble herring stock spawns in northern Hood Canal on eelgrass beds in Port Gamble, Squamish Harbor, and along the eastern shoreline of Hood Canal including waters inside the northern Hood Canal action area (WDFW 1995). The status of this stock is healthy. The matrix criterion for the forage fish indicator is the presence of a natural community of all three forage fish species. Therefore, the forage fish indicator is rated as properly functioning for both the Dabob Bay and northern Hood Canal action areas.

Aquatic vegetation, such as eelgrass and macroalgae, forms a high quality habitat for salmon and other marine organisms (Thom and Hallum 1990). As mentioned above, healthy eelgrass beds exist in the waters of both the Dabob

Bay and northern Hood Canal action areas. Therefore, the aquatic vegetation indicator is rated as properly functioning in both action areas.

Pacific or Japanese oysters (*Crassostrea gigas*) were introduced to the Pacific Northwest from Japan at the beginning of the twentieth century (Elston 1997). Manila clams (*Venerupis philippinarum*) were introduced along with Pacific oysters. Both species are now the basis of multi-million dollar aquaculture industries in Washington State, and are widely distributed in Puget Sound waters, including Dabob Bay and Hood Canal (Chew 1995). However, based on the matrix criteria for the exotic species indicator, the presence of some exotic species places both the Dabob Bay and northern Hood Canal action areas at risk.

6.2.3.4 Indicators Checklist for Project Effects

Table 6-8 contains the indicators checklist for project effects of ongoing or future operations in the Dabob Bay and northern Hood Canal action areas. The reasons for the ratings of project effects shown in the checklist are explained in detail below.

Table 6-8: Indicators checklist for project effects in the Dabob Bay and Hood Canal action areas.

Pathways Indicators	Effects of the Action		
	Restore	Maintain	Degrade
Water Quality			
Turbidity		X	X (rare; temporary)
Dissolved Oxygen		X	
Water contamination / Nutrients		X	X (rare; temporary)
Sediment Contamination		X	X (low; deep water)
Physical Habitat Elements			
Substrate / Armoring		X	
Depth / Slope		X	
Tideland Condition / Filling of Tidelands		X	
Marsh Prevalence / Complexity		X	
Refugia		X	
Physical Barriers (bridges, seawalls, piers floating structures)		X	
Current Patterns		X	
Salt / Fresh Water Mixing Patterns and Locations		X	
Biological Habitat Elements			
Benthic Prey Availability		X	X (rare; temporary)
Forage Fish Prey Availability		X	X (rare; temporary)
Aquatic Vegetation		X	X (rare; temporary)
Exotic Species		X	

Water Quality

As discussed above and in EDAW (2000), turbidity impacts to the water column from recovery of buried torpedoes or other devices have been rare (about 7 times per year) and temporary in nature. In addition, these impacts would most likely take place in deep waters of Dabob Bay or northern Hood Canal far below any depths utilized by salmonids of any life stage. Thus, project actions would maintain existing water quality baseline conditions in the action areas, with water quality degradation due to turbidity a rare, unlikely event with temporary impacts.

No project actions would have any effect on existing dissolved oxygen levels in the action areas. Thus, project actions would maintain existing dissolved oxygen baseline conditions in the Dabob Bay and northern Hood Canal action areas.

Routine ongoing and future operations of the DBRC would maintain existing water quality baseline conditions as measured by the presence of contaminants. As discussed above, however, water quality may be degraded in the action areas as a result of rare, accidental torpedo ruptures or from a fuel, propellant, or hazardous substance spill.

Such rare events would lead to temporary degradation of water quality due to the presence of contaminants in the action areas. These events would be short-lived in nature due to mixing and dilution processes in Dabob Bay and northern Hood Canal. This is supported by the results of the Battelle MSL water quality sampling, which found metal concentrations, including metals (Li, Zr) which potentially could be released in a torpedo rupture, to be comparable to background levels in Puget Sound, and well below Washington State water quality criteria (Crecelius 2001).

As discussed above, any sediment contamination due to heavy metal leaching from lost diamond anchors, dropper weights, or guidance wire would be in insignificant amounts. In addition, this contamination would most likely be in deep waters of Dabob Bay and northern Hood Canal far below depths utilized by salmonids of any life stage. Thus, routine operations of the DBRC would maintain existing sediment contamination baseline conditions in the action areas as far as effects on estuarine salmonid habitat is concerned. This is supported by the results of the Battelle MSL sediment sampling in Dabob Bay, which found metal concentrations well below Washington State sediment quality standards or comparable to naturally occurring levels in sedimentary rock (Crecelius 2001).

Physical Habitat Elements

No direct physical impacts to intertidal and shallow subtidal substrata or habitats utilized by salmonids would result from ongoing or future operations of the DBRC. Thus, there would be no project effects on any of the eight physical habitat elements identified in Table 6-6. Project effects would maintain existing physical habitat baseline conditions in both the Dabob Bay and northern Hood Canal action areas.

Biological Habitat Elements

Routine ongoing and future operations of the DBRC would maintain existing baseline conditions of benthic prey availability in both action areas. As discussed in the EA for this project (EDAW 2000), it is possible that epibenthic invertebrates, preyed upon by juvenile salmonids, could be adversely affected by a fuel, propellant, or other hazardous substance spill connected with range operations. A rare event such as this could temporarily depress the abundance of these prey organisms in the action areas, leading to a potential effect on juvenile salmonids due to low food availability. As also discussed in the project EA, benthic infaunal invertebrates living in deep water sediments on the bottom of Dabob Bay and northern Hood Canal, could be affected by heavy metal leaching from lost anchors, weights, and guidance wire. These sediment-dwelling invertebrates are not preyed upon by juvenile salmonids as they are in water depths far below the shallow nearshore areas utilized by feeding juvenile salmonids.

Routine ongoing and future operations of the DBRC would maintain existing baseline conditions of forage fish prey availability in both action areas. As discussed in the EA for this project (EDAW 2000), it is possible that forage fish, preyed upon by adult salmonids, could be adversely affected by a fuel, propellant, or other hazardous substance spill connected with range operations. A rare event such as this could temporarily depress the abundance of forage fish in the action areas, leading to a potential effect on adult salmonids due to low food availability.

As discussed above in the physical habitat elements section, routine ongoing and future operations of the DBRC would have no direct effect on physical habitat elements of estuarine salmonid habitats, including substrata which maintain eelgrass and macroalgae beds in the action areas. Thus, project actions would maintain existing baseline conditions of aquatic vegetation in both action areas. As discussed in EDAW (2000), it is possible that aquatic vegetation could be adversely affected by fuel, propellant, or other hazardous substance spills connected with range operations. A rare event such as this could temporarily depress the abundance and/or density of aquatic vegetation in the action areas, leading to a potential effect on salmonids due to temporary habitat loss.

Ongoing and future operations of the DBRC would have no effect that would increase the number or abundance of exotic species in the action areas. Therefore, project actions would maintain existing baseline conditions of exotic species in both the Dabob Bay and northern Hood Canal action areas.

6.3 Marine Mammals and Sea Turtles

Potential effects to humpback whales, Steller sea lion, and leatherback sea turtles that may enter Dabob Bay during range testing include noise disturbance and avoidance of habitat, entanglement with torpedo guidewires, collision with boats or torpedoes, and potential effects from released pollutants from ships or torpedo propulsion systems.

From inference regarding noises produced by humpback whales and Steller sea lions, as well as limited sound tests on sea turtles, it is assumed that these species are most sensitive to LF sound. Data on effects to sea turtles from noise are not available. For the impact analysis, it is assumed that they are no more sensitive to noise effects than Steller sea lions or humpback whales. Given the unlikely occurrence of a leatherback sea turtle entering Dabob Bay during a test and limited LF data available on other sea turtle hearing capability, this conservative assumption seems appropriate.

6.3.1 Noise and Disturbance

Steller sea lions appear most susceptible to disturbance from boat noise when they are hauled out on land but often approach boats in the water (Richardson et al, 1995). There are no documented sea lion haulout sites in the project area, probably due to the lack of rocky islands. The shoreline is composed of small, unconsolidated mud or sand beaches. Harbor seals (*Phoca vitulina*) have been documented to haul out on local mudflats, but Steller sea lions have not been documented in these areas. California sea lions use docked submarines for haulouts at Bangor, but no Steller sea lions have been observed at these sites (ROC, James, 1999).

Humpback whale response to boats varies from curiously approaching boats to avoidance of boats. Humpbacks have been documented to change course to apparently avoid a ship several kilometers away, while feeding humpbacks were not disturbed by a large tanker ship that passed within 2,600 feet (800 m). Humpback whales also have shown some apparent avoidance responses and cessation of songs in response to LF sonar ranging from 120 to 150 dB (Richardson et al. 1995). Humpbacks showed no response to acoustic pingers in the 27-30 kHz range (Goodyear 1993). Navy tests of LF sonar impacts on marine mammals also indicate some temporary avoidance and disruption of humpback whale songs to LF sounds in the range of 120 – 150dB. It appears that there is some disturbance to humpbacks from LF noise that is 120 dB or higher, though the extent of disturbance appears to be mild and often temporary (Department of the Navy 1999). It is not clear from existing research, however, the extent to which noise interferes with life-functions of whales or other marine mammals. There are no data available on the long-term effects of underwater noise (NRDC 1999). After a review of existing data and field experiments of LF sound impacts to whales, the Navy concluded that disturbance risk to marine mammals could begin at 120 dB, and the injury threshold for received noise level is 160 dB. Both thresholds were considered to be conservative estimates (Department of the Navy 1999a).

It is therefore likely that the noise from larger boats and the LF noise of the TOSS and some sonar (Table 6-9) could cause any humpback whales in the vicinity of Dabob Bay during a test to avoid the area. This risk is extremely low as humpback whales rarely enter Puget Sound, have not been reported in Dabob Bay, and because of the relatively low noise produced by Navy tests. Table 6-10 shows the sound attenuation of these LF noise sources.

Table 6-9: Impact Matrix for Marine Mammals for the Dabob Bay and Hood Canal MOAs.

Species	Noise		Disturbance		Collision/Entanglement	
	Impact Threshold	Effect	Impact Threshold	Effect	Impact Threshold	Effect
Humpback Whale	Low frequency 160 dB.	No impact, marine mammals surveys conducted and attenuation of LF sound before tests.	Likely occurrence of boats or test vehicle approaching within 100 ft (30 m).	No impact. Marine mammal surveys conducted prior to tests.	Minor chance for potential collision or entanglement.	No impact. Marine mammal surveys conducted prior to tests.
Steller Sea Lion	Unknown but more tolerant than whales. Assume 160 dB as conservative approach.	No impact. There are no haulout areas in the project area, and marine mammal surveys conducted before tests.	Likely occurrence of boats approaching within 300 ft (100 m) while on land, flyover by aircraft below 200 ft (61 m) while on land.	No impact. Marine mammal surveys conducted prior to tests.	Minor chance for potential collision or entanglement.	No impact. Marine mammal surveys conducted prior to tests.

Table 6-10: Sound Attenuation for LF Noise Sources in the Dabob Bay Range Complex.

Source	Noise Level	Distance from Source Where Noise Level is Below 160 dB Threshold
Boats and Torpedo Engine Noise	160 dB	0 yds (0 m)
TOSS	170 dB	4 yds (3.6 m)
Fleet Sonar	247 dB	24,600 yds (22,380 m)

Only the Fleet sonar would have the potential to disturb whales over a broad area of the DBRC. The Fleet sonar has a very limited application and because of its potential effect would not be used at these high power levels without further analysis and consultation with NMFS. The effect of boats, test torpedoes, and the TOSS are negligible. The results of the Navy/NMFS investigation regarding sonar and its effects on beaked whales will be reviewed upon its release for any applicability to DBRC operations.

The TOSS system is used infrequently, approximately 10 tests per year. It should be noted that boat traffic in the Hood Canal, and most of Puget Sound, generates noise that is much greater than produced by DBRC tests. In addition, boat engines are turned off during tests so there is no overlap of noise from boats and test vehicles. Because of the low possibility of occurrence of humpback whales in the project area, risk of a threshold shift (temporary or permanent loss of hearing) in individual whales is not an issue. Surveys prior to testing ensure that no threatened or endangered marine mammals are in the DBRC. The attenuation of Fleet sonar noise (the loudest LF noise) indicates that it would not affect marine mammals outside the DBRC. Similarly, leatherback sea turtles may avoid the project area because of the noise and boat traffic during a test. It is highly unlikely, however, that any sea turtle would visit the project area regardless. Steller sea lions appear to be less affected by boat noise and traffic. Because there are no haulout areas for sea lions in the area and due to the infrequency of their visits to the area, no impacts are anticipated. All Navy boats operating in the vicinity comply with the Marine Mammal Protection Act and the guidelines for approaching or harassing marine mammals. Range operations include wildlife monitoring and reporting to agencies including WDFW, NMFS, and USFWS.

6.3.2 Torpedo Tests

Some test torpedoes trail thin (1 mm) guidance wires as they travel from one end of the range to the other. These wires fall to the bottom substrate, which is composed of mud and organic ooze. These wires could cause some entanglement threat to marine mammals that may be in the area for the short time the wires are in the water column. Humpback whales would be most at risk if they encountered these wires because of their large size and large pectoral flippers. In the unlikely event that a whale did enter the bay during a test and snared a torpedo wire, the wire would probably break, however, because of its small diameter. Guidance wire sizes are 26 gauge for heavyweight guide wires and 240 microns for fiber optic cable. In addition, the Navy’s standard operating procedure is to have marine mammal observers conduct surveys before each test and to postpone tests if marine mammals are spotted in the project area. Navy range operators at Dabob Bay routinely receive training as marine mammal observers. Marine mammals do not frequent the bottom of Dabob Bay, which has a depth range from 375-600 feet (114-183 m); once the guidance wires settle on the bottom, they pose no entanglement threat. Steller seal lions are significantly smaller and more maneuverable than whales, and the potential for entanglement is negligible.

Lightweight torpedoes launched from the air use a small parachute to slow their entry into the water. The parachute detaches from the torpedo and slowly drifts to the bottom of the bay. Air launches are conducted approximately 10 times per year. If marine mammals, such as whales or sea lions, were in the vicinity, they could become entangled in the parachute cord.

Because tests are not conducted if large marine mammals are in the vicinity, there is no risk to humpback whales or sea lions. Therefore, there is no threat of entanglement to humpback whales or Steller sea lions.

Test torpedoes use a variety of propulsion systems including internal combustion engines, chemical energy propulsion systems, electrical propulsion systems, and limited experimental thermal propulsion systems. A release of chemical or fuel pollutants by malfunctioning torpedoes could harm Steller sea lions or humpback whales if they were in the vicinity. The risk is highest for impact tests of torpedoes, where the torpedo strikes a target. The failure of the casings is about 1 percent. There is a possibility that a torpedo could fracture its outer and inner casing on impact with a target, releasing fuel into the water. Most tests do not include target impact, however, and fewer than 10 impact tests may be conducted per year. The risks to marine mammals from such an event are negligible because of the combination of marine mammal surveys prior to tests, the infrequency of humpback whales and Steller sea lions in the project area, the lack of any pollutant spills during tests, and standard Navy protocol for responding to ship or torpedo pollutant releases. This is supported by the results of the Battelle MSL water quality sampling, which found metal concentrations, including metals which potentially could be released in a torpedo rupture, to be comparable to background levels in Puget Sound, and well below Washington State water quality criteria (Crecelius 2001).

The Navy has developed an Oil and Hazardous Substance (OHS) Release Contingency and Response Plan to address the control, containment, and cleanup of oil and hazardous substances as required by OPNAVINST 5090.1B, chapter 10. The OHS Plan identifies actions to be taken to reduce the impact of a propellant or fuel oil spill that may occur as a result of Navy operations.

6.3.3 Collisions

If a humpback whale entered Dabob Bay during a test, there is a potential risk of collision with a boat, test torpedo, a TOSS or other towed target, or with a submarine. Given the Navy's precautions of conducting marine mammal observations before and during tests and the low frequency of humpback occurrence in Puget Sound, the potential of a whale collision is extremely low. If a whale were spotted while a test was already in progress, the test would be shut down and all vehicles would stop. Tests would not resume until marine mammals left the DBRC area.

NMFS, which administers the MMPA for species that may occur in the DBRC, recommends that vessels not intentionally approach within 100 yards (91 m) of marine mammals (NMFS undated). All Navy vessels comply with this directive.

6.4 Terrestrial Species

6.4.1 Bald Eagle

Because of a relatively high density of breeding eagles in the project area, there is the potential for test activities to disturb eagle nesting or foraging. Navy boat traffic in the DBRC could cause bald eagles to temporarily avoid some areas of Dabob Bay used for foraging, and the use of helicopters and planes for various test operations could disturb perching or nesting eagles if flights were too low over the tree canopy. Fixed-wing planes and helicopters are used to launch torpedoes in the test range, and helicopters are used to recover some torpedoes after testing is complete. Fixed-wing aircraft are primarily P-3s, launch helicopters are SH-60s, and recovery helicopters are Hughes 500s. Fixed-wing aircraft fly at a typical elevation of about 1,000 feet (304 km). Helicopters fly as low as 50 feet (15.2 m) when recovering torpedoes from the water and to set the recovered torpedo at the helicopter pad at Zelatched Point. When travelling from one point to another, helicopters maintain a 500-foot (152 m) elevation over water and 1,000 feet (304 km) over land. The fixed-wing aircraft usually fly at higher elevations. Estimates for the next several years include 10-15 fixed wing aircraft torpedo launches/year, 20-30 helicopter launches/year, and 10-20 helicopter recoveries/year.

Bald eagles are more susceptible to disturbance from helicopters than from fixed-wing aircraft. Helicopters often radiate more sound forward than backward, and can be heard for a longer time as they approach than as they move away (Richardson et al. 1995). Observations in Puget Sound indicate that about half of nesting bald eagles react to close approach by helicopters while only 7% react to approaches by fixed-wing aircraft (Watson 1993). Watson (1993) recommended that helicopters approach bald eagle nests at a elevation no less than 197 feet (60 m) above the nest, which minimized disturbance and allowed an escape route for any flushed birds. Grub and King (1991) recommended an aircraft exclusion zone of 2,050 feet (625 m) around eagle nests to avoid disturbance effects, with short duration flights allowed within 3,608 feet (1,100 m).

Navy aircraft pilots generally fly at least 1,000 feet (304 m) above land and 500 feet (152 m) above the water. Helicopter recoveries would have the greatest potential for disturbance of nesting eagles because the helicopters must fly low over the water to recover the test torpedo and to place it at the landing pad at Zelatched Point. While there are no eagle nesting locations at Zelatched Point, there is a nest about 1 mile (1.6 km) NNE from the landing pad, and several farther north along the Toandos Peninsula. The risk of disturbance would be greatest if during launch preparations or after recovering a torpedo a helicopter were to travel close to the shoreline at a low (<500 feet [152 m]) elevation. The Navy will prevent potential impacts to nesting eagles by not allowing flights within a 656 ft (200 m) buffer zone around the eagle nests. Flight rules have been formally adopted in the OMP and would significantly reduce the potential for effects to nesting bald eagles. These flight rules are as follows.

Rotary Wing Aircraft Operations at the DBRC

General flight rules include:

- Flights over land must be at least 1,000 (304 m) feet above the level of the land;
- Flights over water must be at least 500 feet (152 m) above the level of the sea;
- Flights must maintain a 656 foot (200 m) lateral no-fly area around bald eagle nests; and
- Flights within 500 yards (457 m) of the shore (beach) must be at least 1,000 feet (304 m) above sea level.

Exceptions to these rules include:

- Landing/takeoff of rotary wing aircraft at Zelatched Point within landing constraints;
- Launch of weapons or vehicles over the range area; and
- Retrieval of weapons or vehicles over the range area.

Landing/takeoff constraints:

- Approach and departure from Zelatched Point helipad will not be from an overland direction (generally easterly or southerly direction); and
- The approach will be from an over water direction roughly parallel to the shoreline with the exact approach direction dictated by the current wind conditions.

Fixed-Wing Aircraft Operations at Dabob Bay Range Area

General flight rules include:

- Flights over land must be at least 1,000 feet (304 m) above the level of the land;
- Flights over water must be at least 500 feet (152 m) above the level of the sea;

- Flights must maintain a 656 foot (200 m) lateral no-fly zone around bald eagle nests; and

- Flights within 500 yards (457 m) of the shore (beach) must be at least 1,000 feet (304 m) above sea level.

Exceptions to these rules include:

- Launch of weapons or vehicles over the range area.

Fixed-wing aircraft approaching the range area shall not descend below 500 feet (152 m) for a launch until they are over the military operating area and more than 500 yards (457 m) off the shore (beach). These operations will be generally along the range centerline or in a northerly (011^{o}T or 351^{o}M)/southerly (191^{o}T or 171^{o}M) direction (T-true north, M-magnetic north.

Because there are no ports, large towns, or marinas in the project area, boat traffic is limited to fishing, recreation, and occasional boats to and from oyster farms in Quilcene Bay. Navy vessels used during tests will not disrupt eagle nesting or foraging in the project area. Navy vessels approach the Dabob Bay shoreline only when docking at the Zelatched Point facility, where there are no documented eagle nests (WDFW 1999a) The closest eagle nest is about 1 mile (1.6 km) away.

6.4.2 Marbled Murrelet

The project will have no effect on marbled murrelet nesting areas, which are located several miles from Dabob Bay. In addition, the vast majority of vessel traffic associated with testing occurs along the center line of Dabob Bay. Seabird surveys indicate that marbled murrelet concentrations in the Hood Canal area are variable throughout the winter, and these birds generally feed within 1,640 feet (500 m) of shore. Recovery of torpedoes and the subsequent approach of the helicopter to the Zelatched Point landing site could cause some disturbance to any marbled murrelets that were feeding in this vicinity. It is likely that any birds in the area would disperse away from the landing site. These effects would be negligible.

7.0 Management actions related to the species

No mitigation measures are necessary and none proposed

8.0 CONCLUSIONS AND EFFECTS DETERMINATION

8.1 Fisheries

An effect determination for effects of project actions of ongoing and future operations of the DBRC on Hood Canal summer-run chum salmon, Puget Sound chinook salmon, and coastal/Puget Sound bull trout was made using the dichotomous key and definitions in NMFS (1996). This determination was based on the analysis presented in this Biological Assessment and the pathways and indicators matrix analysis, and consisted of the following choices in the key:

- Naturally spawned populations of Hood Canal summer-run chum salmon and Puget Sound chinook salmon are documented as occurring in the waters of Dabob Bay and northern Hood Canal, defined as the action areas for project effects. In addition, anadromous coastal / Puget Sound bull trout from the South Fork Skokomish River are likely, but not certain, to be present in the waters of Dabob Bay and northern Hood Canal. Therefore, project actions may affect these three salmonid species.

- Based on Tables 6-6 and 6-7, the project actions will not have the potential to hinder attainment of relevant properly functioning indicators.

- Based on the Biological Assessment analysis, there is a negligible (extremely low) probability of take of proposed/listed anadromous salmonids or destructive/adverse modification of proposed/designated critical habitat". Therefore, project actions are not likely to adversely affect the listed salmonid species or their habitat.

Therefore, it is concluded that: (1) the project actions of ongoing and future operations of the DBRC may affect, but not likely to adversely affect threatened Hood Canal summer-run chum salmon, Puget Sound chinook salmon, and coastal/Puget Sound bull trout that are present in the Dabob Bay and northern Hood Canal action areas; (2) project actions would not destroy or adversely modify proposed critical habitat, or jeopardize the continued existence of these three species, according to definitions in NMFS (1996); and (3) the same effect determinations would apply to acoustic emissions generated by DBRC operations, which were evaluated separately.

8.2 Marine Mammals and Sea Turtles

Humpback whales, Steller sea lions, and leatherback sea turtles are rare visitors to Puget Sound. Humpback whales have been observed infrequently in Puget Sound, but there are no records from the Dabob Bay project area. Steller sea lions most likely occur in the Hood Canal and Dabob Bay area in late winter and early spring before moving on to northern breeding sites.

Leatherback sea turtles rarely enter Puget Sound. If any of these species did enter the project area during a test, LF noise from boats and some target simulators might cause them to avoid portions of the project area. The continued use of the DBRC would have no effect to these species because of the relatively low level of noise produced by Navy tests, the attenuation of the sound over distance, the precaution of implementing marine mammal surveys prior and during tests, and the infrequency of occurrence of these species in the project area. The threat of collisions between marine mammals and boats or test torpedoes, fuel releases from boats or torpedoes, or entanglement with torpedo guidance wires is negligible. If marine mammals are observed in the project area prior to or during a test, the test will be postponed.

Based on these conclusions ongoing and future operations of the DBRC would have no effect to humpback whales, leatherback sea turtles, or Steller sea lions.

8.3 Terrestrial Species

The project would have no effect to spotted owls or marbled murrelets that occur in the project area. These species occur in habitat that is several miles from Dabob Bay and not within the project's zone of influence. Navy activity is focused on the center of Dabob Bay and the Hood Canal MOAs. Marbled murrelets that feed within 1,640 feet (500 m) of shore would not be affected by the minor amount of vessel traffic associated with Navy testing.

Bald eagles that nest in the project area could be affected by low flying helicopters or fixed-wing aircraft. The Navy's standard flight rules for the DBRC have been adopted into the OMP. This will ensure the protection of nesting bald eagles from disturbance by helicopters or fixed-wing aircraft.

9.0 REFERENCES

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9.2 Records of Communication

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Jackson, G.A. 1999. Letter from Mr. Gerry A. Jackson of the Western Washington Office of the U.S. Fish and Wildlife Service (USFWS) sent to Ms. Kimberly Kler of the Department of the Navy, Engineering Field Activity, Northwest (EFA Northwest), dated September 16, 1999.

James, Tom. 1999. Wildlife Biologist, U.S. Navy, Sub-base Bangor. Provided information to J. Keany, EDAW, on the use of Hood Canal and vicinity by marine mammals. October 14, 1999.

Jeffries, Steve. 1999. Biologist, Washington Department of Fish and Wildlife, Tacoma, WA. Provided data to J. Keany, EDAW, on use of Dabob Bay by harbor seals and sea lions. October 7, 1999.

Kler, K. 1999a. Letter from Ms. Kimberly Kler of the Department of the Navy, Engineering Field Activity, Northwest (EFA Northwest) to Mr. Gordon Zillges of the Washington State Habitat Branch of the National Marine Fisheries Service (NMFS), dated July 15, 1999.

Kler, K. 1999b. Letter from Ms. Kimberly Kler of Department of the Navy, Engineering Field Activity, Northwest (EFA Northwest) to Ms. Bobbi Barrera of the Western Washington Office of the U.S. Fish and Wildlife Service (USFWS), dated July 15, 1999.

Landino, S. 1999. Letter from Mr. Steven Landino of the National Marine Fisheries Service (NMFS) to Mr. Gerald M. Erickson of Polaris Applied Sciences dated August 10, 1999.

NUWC 1999a. Telephone conversation with Gerald Erickson of Polaris Applied Sciences, Inc., September 1, 1999.

NUWC 1999b. Information provided during Preliminary EA review meeting at EFA Northwest in Poulsbo, WA, December 20, 1999.

NUWC 2000a. Information provided in email message to Jim Keany of EDAW, Inc., January 25, 2000.

NUWC 2000b. Information provided in email message to Gerald Erickson of Polaris Applied Sciences, Inc., January 19, 2000.

APPENDIX A

Correspondence

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
19917 7TH AVENUE N.E.
POULSBO, WASHINGTON 98370-7570

5090
Ser 183KK/5257
JUL 15 1999

Mr. Gordon Zillges
National Marine Fisheries Service Northwest Region
Washington State Branch Office
Habitat Conservation Division
510 Desmond Drive Southeast; Suite 103
Lacey Washington 98503

Dear Mr. Zillges:

EDAW, Inc. of Seattle, Washington and Polaris Applied Sciences, Inc. of Kirkland, Washington are assisting the U.S. Navy with the preparation of Environmental and Biological Assessments for ongoing and future operational activities in the Dabob Bay and Hood Canal Military Operating Areas (MOAs) and connecting waters. This letter is a formal request for a data search on federally endangered, threatened and candidate species under the jurisdiction of NMFS which may be found in and near the MOAs and connecting waters. A map has been attached for your convenience. A letter is also being sent to the U.S. Fish and Wildlife Service (USFWS) requesting information on endangered, threatened and candidate species under the jurisdiction of the USFWS. Information regarding these species should be sent to:

Mr. Jim Keany
EDAW, Inc.
1505 Western Avenue
Suite 601
Seattle, Washington 98101
(206) 622-1176

Mr. Gerald Erickson
Polaris Applied Sciences, Inc.
12509 130th Lane NE
Kirkland, Washington 98034-7713
(425) 823-4841

If you have any questions regarding this request you may contact me at (360) 396-0927.

Sincerely,

Kimberly H. Kler

KIMBERLY H. KLER
Environmental Planner

Copy to:
Mr. Jim Keany; EDAW, Inc.
Mr. Gerald Erickson; Polaris Applied Sciences, Inc.

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
19917 7TH AVENUE N.E.
POULSBO, WASHINGTON 98370-7570

5090
Ser 183KK/5258
JUL 15 1999

Ms. Bobbi Barrera
United States Fish and Wildlife Service
510 Desmond Drive Southeast; Suite 102
Lacey Washington 98503

Dear Ms. Barrera:

EDAW, Inc. of Seattle, Washington and Polaris Applied Sciences, Inc. of Kirkland, Washington are assisting the U.S. Navy with the preparation of Environmental and Biological Assessments for ongoing and future operational activities in the Dabob Bay and Hood Canal Military Operating Areas (MOAs) and connecting waters. This letter is a formal request for a data search on federally endangered, threatened and candidate species under the jurisdiction of USFWS, which may be found in and near the MOAs and connecting waters. A map has been attached for your convenience. A letter is also being sent to the National Marine Fisheries Service (NMFS) requesting information on endangered, threatened and candidate species under the jurisdiction of NMFS. Information regarding these species should be sent to:

Mr. Jim Keany
EDAW, Inc.
1505 Western Avenue
Suite 601
Seattle, Washington 98101
(206) 622-1176

Mr. Gerald Erickson
Polaris Applied Sciences, Inc.
12509 130th Lane NE
Kirkland, Washington 98034-7713
(425) 823-4841

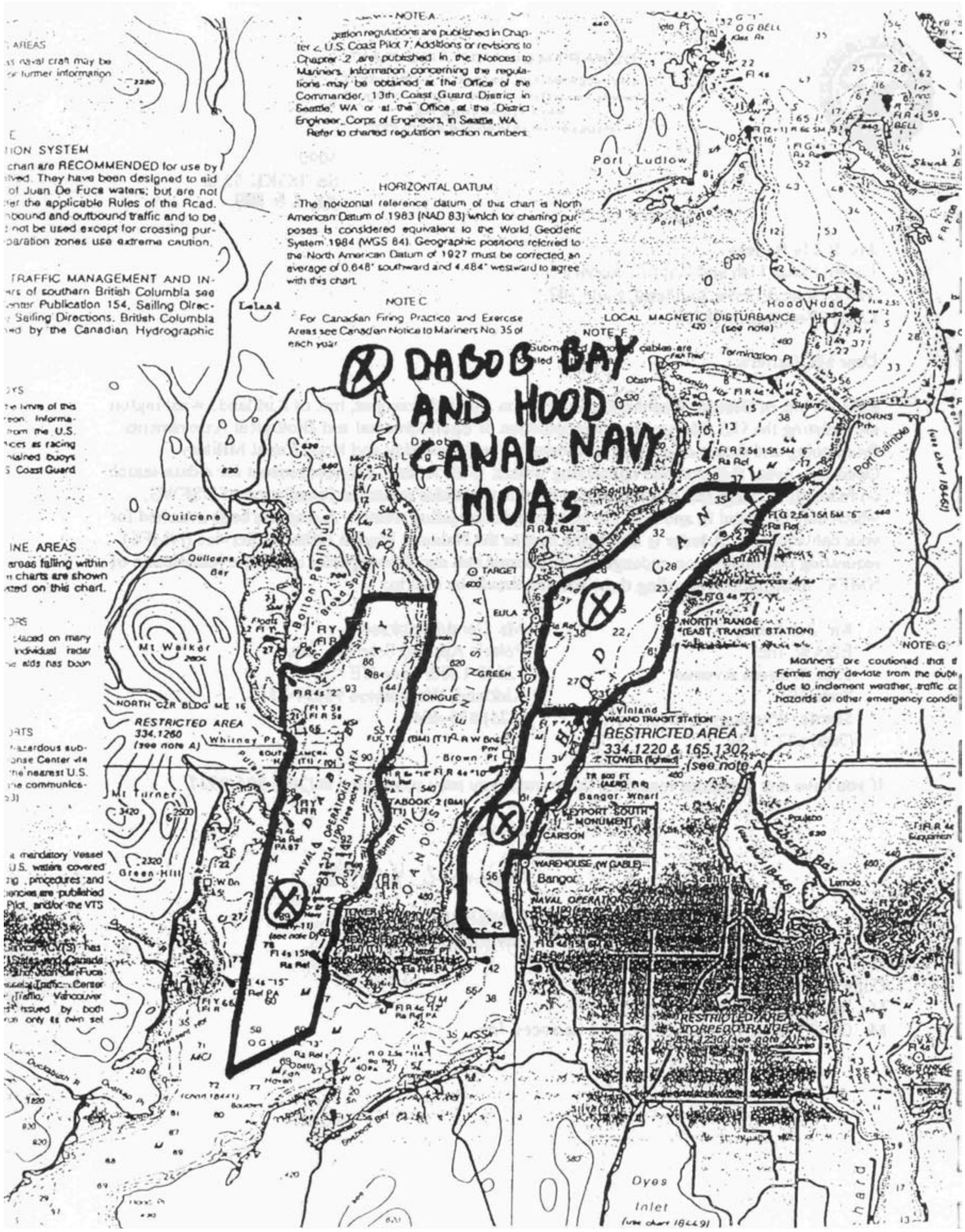
If you have any questions regarding this request you may contact me at (360) 396-0927.

Sincerely,

Kimberly H. Kler

KIMBERLY H. KLER
Environmental Planner

Copy to:
Mr. Jim Keany; EDAW, Inc.
Mr. Gerald Erickson; Polaris Applied Sciences, Inc.


DABOB BAY
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Hood Head
Quilcene
Mt Walker
Mt Turner
Green Hill
Bangor
Dyes
Inlet

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
19917 7TH AVENUE N.E.
POULSBO, WASHINGTON 98370-7570

JUL 15

5090
Ser 183KK/5254
JUL 13 1999

Ms. Lori Guggenmos
Priority Habitats and Species
Washington Department of Fish and Wildlife
600 Capitol Way North
Olympia, Washington 98501-1091

RE: Priority Habitats and Species (PHS) map and data request

Dear Ms. Guggenmos:

We would like to request two sets of the PHS paper maps (1:24,000 scale) and associated data for the following six USGS 7.5 minute quadrangles: 1) Mount Walker, 2) Quilcene, 3) Lofall, 4) Brinnon, 5) Seabeck, and 6) Poulsbo. These maps and data will be used to assess potential environmental impacts of ongoing and future operational activities in the US Navy Military Operating Areas in Dabob Bay and Hood Canal as part of an Environmental Assessment document which is being prepared by EDAW, Inc. and Polaris Applied Sciences, Inc. Please send the two sets of maps and data (and invoice) to:

Mr. Gerald Erickson
Polaris Applied Sciences
12509 130th Lane NE
Kirkland, Washington 98034-7713
(425) 823-4841

Polaris Applied Sciences has a current Memorandum of Understanding (MOU) on file with WDFW regarding the use of PHS data, with Mr. Erickson listed as one of the Polaris personnel authorized to receive this data. The second set of maps and data will be transmitted to EDAW, Inc. in Seattle, which also has a current MOU on file with WDFW.

Sincerely,

Kimberly H. Kler

KIMBERLY H. KLER
Environmental Planner

Copy to:
Mr. Gerald Erickson; Polaris Applied Sciences
Mr. Jim Keany; EDAW, Inc.

State of Washington

DEPARTMENT OF FISH AND WILDLIFE

Mailing Address: 600 Capitol Way N, Olympia, WA 98501-1091 - (360) 902-2200; TDD (360) 902-2207
Main Office Location: Natural Resources Building, 1111 Washington Street SE, Olympia, WA

Date: Aug 2, 1999

Dear Habitats and Species Requester:

Enclosed are the habitats and species products you requested from the Washington Department of Fish and Wildlife (WDFW). This package may also contain documentation to help you understand and use these products.

These products only include information that WDFW maintains in a computer database. They are not an attempt to provide you with an official agency response as to the impacts of your project on fish and wildlife, nor are they designed to provide you with guidance on interpreting this information and determining how to proceed in consideration of fish and wildlife. These products only document the location of important fish and wildlife resources to the best of our knowledge. It is important to note that habitats or species may occur on the ground in areas not currently known to WDFW biologists, or in areas for which comprehensive surveys have not been conducted. Site-specific surveys are frequently necessary to rule out the presence of priority habitats or species.

Your project may require further field inspection or you may need to contact our field biologists or others in WDFW to assist you in interpreting and applying this information. Generally, for assistance on a specific project, you should contact the WDFW Habitat Program Manager for your county and ask for the area habitat biologist for your project area. Refer to the enclosed directory for those contacts.

Please note that sections potentially impacted by spotted owl management concerns are displayed on the 1:24,000 scale standard map products. If specific details on spotted owl site centers are required they must be requested separately.

These products are designed for users external to the forest practice permit process and as such does not reflect all the information pertinent to forest practice review. The Forest Practice Rules adopted August 22, 1997 by the Forest Practice Board and administered by the Washington Department of Natural Resources require forest practice applications to be screened against marbled murrelet detection areas and detection sections. Marbled murrelet detection locations are included in the standard priority habitats and species products, but the detection areas and detection sections are not included. If your project is affected by Forest Practice Regulations, you should specially request murrelet detection areas.

WDFW updates this information as additional data become available. Because fish and wildlife species are mobile and because habitats and species information changes, project reviews for fish and wildlife should not rest solely on mapped information. Instead, they should also consider new information gathered from current field investigations. Remember, habitats and species information can only show that a species or habitat type is present, they cannot show that a species or habitat type is not present. These products should not be used for future projects. Please obtain updates rather than use outdated information.

July 1998

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
REGIONAL HABITAT PROGRAM MANAGER CONTACTS

For assistance with Priority Habitats and Species Information contact a regional habitat program manger and they will direct your questions to a biologist.

County project is in...	**Contact...**
Asotin, Columbia, Ferry, Garfield Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman	John Andrews 8702 North Division Street Spokane, WA 99218-1199 Phone: (509) 456-4082
Adams, Chelan, Douglas, Grant, Okanogan	Tracy Lloyd 1550 Alder Street NW Ephrata, WA 98823-9699 Phone: (509) 754-4624
Benton, Franklin, Kittitas, Yakima	Ted Clausing 1701 24th Avenue Yakima, WA 98902-5720 Phone: (509) 575-2740
Island, King, San Juan, Skagit, Snohomish, Whatcom	Ted Muller 16018 Mill Creek Blvd. Mill Creek, WA 98012-1296 Phone: (206) 775-1311
Clark, Cowlitz, Klickitat, Lewis, Skamania, Wahkiakum	Rich Costello 2108 Grand Blvd. Vancouver, WA 98661 Phone: (360) 696-6211
Clallam, Grays Harbor, Jefferson, Kitsap, Mason, Pacific, Pierce, Thurston	Steve Keller 48 Devonshire Road Montesano, WA 98563-9618 Phone: (360) 249-4628

July 1998

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
HABITAT PROGRAM/OLYMPIA FIELD OFFICE
510 Desmond Drive SE/Suite 103
LACEY, WASHINGTON 98503

August 10, 1999

AUG 13 1999

Mr. Jim Keany
EDAW, Inc.
1505 Western Avenue, Suite 601
Seattle, Washington 98101

Re: Species List Requests, Dabob Bay and Hood Canal Military Operating Areas

Dear Mr. Keany:

The National Marine Fisheries Service (NMFS) is responding to the above-referenced request of Ms. Kimberly H. Kler, Environmental Planner for the Department of the Navy. Ms. Kler has requested that our response be sent directly to you. We have enclosed a list of those anadromous fish species that are listed as Threatened or Endangered, those that are proposed for listing, and those that are candidates for listing under the Endangered Species Act (ESA). This inventory only includes those anadromous species under NMFS' jurisdiction. The U.S. Fish and Wildlife Service should be consulted regarding the presence of species falling under their jurisdiction.

Presently, Puget Sound chinook salmon (*Onchorynchus tshawytscha*) and Hood Canal Summer Chum (*O. Keta*) are listed as Threatened and are present in the nearshore marine environment in Dabob Bay and Hood Canal from March 1 to July 30 each year. Also, please be aware that coho salmon (*O. kitsutch*) occur in these areas as well, and are candidate species eligible for listing under the ESA. Although candidate species are not afforded protection under the ESA, it would be prudent to incorporate project design features that avoid or minimize impacts to anadromous fish resources should they become listed at a later date.

Thank you for your inquiry for information pertaining to federally listed T and E species. Should you require additional information, please contact Mr. Thom Hooper at (360) 753-9453 or at the letterhead address.

Sincerely,

Steven W. Landino
Washington State Habitat Branch Chief

Enclosure

cc: Kimberly H. Kler, Navy
Hooper, WSHB

ESA STATUS - WASHINGTON STATE ANADROMOUS SALMONIDS - APRIL 1999

Species	(E=endangered, T=threatened, Date is for FR publication)		
	Listed	Proposed	Candidate
Coho (Oncorhynchus kisutch)	None	None	1) Puget Snd/St. of Georgia (7/95) 2) SW WA/L. Col. R. (7/95)
Steelhead (O. mykiss)	1) Upper Col. R. (E - 8/97) 2) Snake R. (T - 8/97) 3) Lower Col. R. (T - 3/98) 4) Middle Col. R. (T - 3/99)	None	None
Chum (O. keta)	1) Hood Canal Summer (T-3/99) 2) Columbia River (T-3/99)	None	None
Chinook (O. tshawytscha)	1) Snake R. fall (T - 4/92) 2) Snake R. spg/smmr (T - 4/92) 3) Upper Col. R. Spring (E - 3/99) 4) Puget Sound (T - 3/99) 5) Lower Col. R. (T-3/99)	None	None
Sockeye (O. nerka)	1) Snake R. (E - 11/91) 2) Ozette Lake (T - 3/99)	None	None
Pink (O. gorbuscha)	None	None	None
Sea-run Cutthroat (O. clarki clarki)	None	1) SW Wash/Col River (T-4/99)	None

NOTE: Listing rules announced on 3/24-25/99 will become effective 60 days after Federal Register publishing.

Table 2. ENDANGERED AND THREATENED MARINE MAMMALS AND SEA TURTLES UNDER THE JURISDICTION OF NATIONAL MARINE FISHERIES SERVICE THAT MAY OCCUR OFF WASHINGTON AND OREGON

MARINE MAMMALS

Humpback Whale	*Megaptera novaeangliae*
Blue Whale	*Balaenoptera musculus*
Fin Whale	*Balaenoptera physalus*
Sei Whale	*Balaenoptera borealis*
Sperm Whale	*Physeter macrocephalus*
Steller Sea Lion	*Eumetopias jubatus*

MARINE TURTLES

Leatherback Sea Turtle	*Dermochelys coriacea*
Loggerhead Sea Turtle	*Caretta caretta*

****

ENDANGERED AND THREATENED MARINE MAMMALS AND SEA TURTLES UNDER THE JURISDICTION OF NATIONAL MARINE FISHERIES SERVICE THAT MAY OCCUR IN THE PUGET SOUND

MARINE MAMMALS

Humpback Whales	*Megaptera novaeangliae*
Steller Sea Lion	*Eumetopias jubatus*

MARINE TURTLES

Leatherback Sea Turtle	*Dermochelys coriacea*

United States Department of the Interior

FISH AND WILDLIFE SERVICE
North Pacific Coast Ecoregion
Western Washington Office
510 Desmond Drive SE, Suite 102
Lacey, Washington 98503
Phone: (360) 753-9440 Fax: (360) 753-9518

SEP 22 1999

SEP 16 1999

Dear Species List Requester:

You have requested a list of listed and proposed threatened and endangered species, candidate species, and species of concern (Attachment A) that may be present within the area of your proposed project. This response fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act of 1973, as amended (Act). We have also enclosed a copy of the requirements for Federal agency compliance under the Act (Attachment B).

Should the Federal agency determine that a listed species is likely to be affected (adversely or beneficially) by the project, you should request section 7 consultation through this office. If the Federal agency determines that the proposed action is "not likely to adversely affect" a listed species, you should request Service concurrence with that determination through the informal consultation process. Even if there is a "no effect" situation, we would appreciate receiving a copy for our information.

Both listed and proposed species may occur in the vicinity of the project. Therefore, pursuant to the regulations implementing the Act, impacts to both listed and proposed species must be considered by the Federal agency in a biological assessment (BA) (see Attachment B for more information on preparing BAs). Formal conference with the Service is required by the Act if the Federal agency determines that the proposed action is likely to jeopardize the continued existence of a proposed species, or result in the destruction or adverse modification of proposed critical habitat. The results of the BA will determine if conferencing is required. If the species is ultimately listed, your agency may be required to reinitiate consultation.

Candidate species are included simply as advance notice to Federal agencies of species which may be proposed and listed in the future. Species of concern are those species whose conservation standing is of concern to the Service, but for which further status information is still needed. Conservation measures for species of concern are voluntary, but recommended. Protection provided to these species now may preclude possible listing in the future.

There may be other Federally listed species that may occur in the vicinity of your project which are under the jurisdiction of the National Marine Fisheries Service (NMFS). Please contact NMFS at (360) 753-9530 to request a species list.

In addition, please be advised that Federal and state regulations may require permits in areas where wetlands are identified. You should contact the Seattle District of the U.S. Army Corps of Engineers for Federal permit requirements and the Washington State Department of Ecology for State permit requirements.

Your interest in endangered species is appreciated. If you have additional questions regarding your responsibilities under the Act, please contact Bobbi Barrera at (360) 753-6048, or John Grettenberger of this office, at the letterhead phone/address.

Sincerely,

Gerry A. Jackson
Supervisor

BB
Enclosure(s)

c:WDFW Region 6

letter4

ATTACHMENT A **September 9, 1999**

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, CANDIDATE SPECIES AND SPECIES OF CONCERN WHICH MAY OCCUR WITHIN THE VICINITY OF THE PROPOSED DABOB BAY AND HOOD CANAL OPERATIONAL ACTIVITIES IN JEFFERSON AND KITSAP COUNTIES, WASHINGTON

(T25N R02W;T25N R01W;T25N R01E S04-06,07-09,16-18,19-21,28-30; T26N R02W;T26N R01W;T26N R01E S04-06,07-09,16-18,19-21,28-30,31-33; T27N R02W S01-04,09-12,13-16,21-24,25-28,33-36;T27N R01W;T27N R01E)

FWS REF. #: 1-3-99-SP-1072

LISTED

Bald eagle (*Haliaeetus leucocephalus*) - There are 31 bald eagle nesting territories located in the vicinity of the project at T24N R01E S03;T24N R02W S02,03;T25N R01E S01,12,20;T25N R01W S02,03,05,19;T25N R02E S14,31;T25NR02W S01,21,25,29;T26N R01E S22,28;T26N R01W S06,07,10,11,16,22;T26N R021W S24;T27N R01E S04,20,28;T27N R02E S06,07,18;T27N R01W S17,24,25,29,32. Nesting activities occur from January 1 through August 15.

There are two bald eagle roost sites located in the vicinity of the project at T26N R01W S18;T27N R02W S24.

Wintering bald eagles may occur in the vicinity of the project. Wintering activities occur from October 31 through March 31.

Marbled murrelet (*Brachyramphus marmoratus*) - occur in the vicinity of the project. Nesting activities occur from April 1 through September 15.

Northern spotted owl (*Strix occidentalis caurina*) - occur in the vicinity of the project. Nesting activities occur from March 1 through September 30.

Major concerns that should be addressed in your biological assessment of the project impacts to listed species are:

1. Level of use of the project area by listed species.

2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project.

3. Impacts from project construction (i.e., habitat loss, increased noise levels, increased human activity) which may result in disturbance to listed species and/or their avoidance of the project area.

DESIGNATED

Critical habitat for the marbled murrelet has been designated in the vicinity of the project.

Critical habitat for the northern spotted owl has been designated in the vicinity of the project.

PROPOSED

Bull trout (*Salvelinus confluentus*) - Coastal/Puget Sound population occur in the vicinity of the project.

CANDIDATE

The following candidate species may occur in the vicinity of the project:

Oregon spotted frog (*Rana pretiosa*)

SPECIES OF CONCERN

The following species of concern may occur in the vicinity of the project:

California wolverine (*Gulo gulo luteus*)
Cascades frog (*Rana cascadae*)
Long-eared myotis (*Myotis evotis*)
Long-legged myotis (*Myotis volans*)
Northern goshawk (*Accipiter gentilis*)
Olive-sided flycatcher (*Contopus cooperi*)
Olympic torrent salamander (*Rhyacotriton olympicus*)
Pacific fisher (*Martes pennanti pacifica*)
Pacific lamprey (*Lampetra tridentata*)
Pacific Townsend's big-eared bat (*Corynorhinus townsendii townsendii*)
River lamprey (*Lampetra ayresi*)
Tailed frog (*Ascaphus truei*)

letter4

ATTACHMENT B

FEDERAL AGENCIES' RESPONSIBILITIES UNDER SECTIONS 7(a) AND 7(c) OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED

SECTION 7(a) - Consultation/Conference

Requires:

1. Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;

2. Consultation with FWS when a federal action may affect a listed endangered or threatened species to ensure that any action authorized, funded, or carried out by a federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The process is initiated by the federal agency after it has determined if its action may affect (adversely or beneficially) a listed species; and

3. Conference with FWS when a federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or an adverse modification of proposed critical habitat.

SECTION 7(c) - Biological Assessment for Construction Projects *

Requires federal agencies or their designees to prepare a Biological Assessment (BA) for construction projects only. The purpose of the BA is to identify any proposed and/or listed species which is/are likely to be affected by a construction project. The process is initiated by a federal agency in requesting a list of proposed and listed threatened and endangered species (list attached). The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the species list, please verify the accuracy of the list with the Service. No irreversible commitment of resources is to be made during the BA process which would result in violation of the requirements under Section 7(a) of the Act. Planning, design, and administrative actions may be taken; however, no construction may begin.

To complete the BA, your agency or its designee should: (1) conduct an onsite inspection of the area to be affected by the proposal, which may include a detailed survey of the area to determine if the species is present and whether suitable habitat exists for either expanding the existing population or potential reintroduction of the species; (2) review literature and scientific data to determine species distribution, habitat needs, and other biological requirements; (3) interview experts including those within the FWS, National Marine Fisheries Service, state conservation department, universities, and others who may have data not yet published in scientific literature; (4) review and analyze the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; (5) analyze alternative actions that may provide conservation measures; and (6) prepare a report documenting the results, including a discussion of study methods used, any problems encountered, and other relevant information. Upon completion, the report should be forwarded to our Endangered Species Division, 510 Desmond Drive SE, Suite 102, Lacey, WA 98503-1273.

*

"Construction project" means any major federal action which significantly affects the quality of the human environment (requiring an EIS), designed primarily to result in the building or erection of human-made structures such as dams, buildings, roads, pipelines, channels, and the like. This includes federal action such as permits, grants, licenses, or other forms of federal authorization or approval which may result in construction.

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
19917 7TH AVENUE N.E.
POULSBO, WASHINGTON 98370-7570

5090
Ser 05EP.KK/5069
APR 26 2000

Bobbi Barrera
U.S. Fish and Wildlife Service
510 Desmond Drive SE, Suite 102
Lacey, WA 98503

Re: Environmental Assessment/Biological Assessment for Ongoing and Future Operations at U.S. Navy Dabob Bay and Hood Canal Military Operating Areas

Dear Ms. Barrera:

Naval Undersea Warfare Center Division Keyport (NUWC Division Keyport) is seeking your concurrence with the determinations made in the enclosed Environmental Assessment (EA) and Biological Assessment (BA), Appendix C, for NUWC Division, Keyport's ongoing and future operations at U.S. Navy Dabob Bay and Hood Canal Military Operating Areas. The enclosed BA, assesses possible impacts to both U.S. Fish and Wildlife Service and National Marine Fisheries Service (NMFS) listed species. Analysis presented in the BA concludes an Effect Determination of "may affect, not likely to adversely affect" for the coastal/Puget Sound bull trout and bald eagles. The BA also concludes an Effect Determination of "no effect" for the spotted owls and marbled murrelets.

Please forward any comments on the Draft EA and your concurrence to me at the above address. Comments on the Draft EA will be needed by May 30, 2000. A determination of concurrence on the BA received by June 30, 2000 would be most appreciated. If you need additional information or have any questions, please feel free to contact me by phone at (360) 396-0927 or by e-mail at klerkh@efanw.navfac.navy.mil.

Sincerely,

Kimberly Kler

KIMBERLY KLER
Environmental Planner

Enclosure:
(1) Draft Environmental Assessment for ongoing and future operations at U.S. Navy Dabob Bay and Hood Canal Military Operating Areas

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
19917 7TH AVENUE N.E.
POULSBO, WASHINGTON 98370-7570

5090
Ser 05EP.KK/5070
APR 26 2000

Thom Hooper
National Marine Fisheries Service
Habitat Program/Olympia Field Office
510 Desmond Drive SE, Suite 103
Lacey, WA 98503

Re: Environmental Assessment/Biological Assessment for Ongoing and Future Operations at U.S. Navy Dabob Bay and Hood Canal Military Operating Areas

Dear Mr. Hooper:

Naval Undersea Warfare Center Division Keyport (NUWC Division Keyport) is seeking your concurrence with the determinations made in the enclosed Environmental Assessment (EA) and Biological Assessment (BA), Appendix C, for NUWC Division, Keyport's ongoing and future operations at U.S. Navy Dabob Bay and Hood Canal Military Operating Areas. The enclosed BA, assesses possible impacts to both National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service listed species. Analysis presented in the BA concludes an Effect Determination of "may affect, not likely to adversely affect" on the Hood Canal summer-run chum salmon and Puget Sound chinook salmon. The BA also concludes an Effect Determination of "no effect" on humpback whales, leatherback sea turtles and steller sea lions. In addition the EA determines that the proposed action will have "no effect" on Essential Fish Habitat for West Coast Groundfish in Dabob Bay and Northern Hood Canal. The discussion on Essential Fish Habitat may be found is in Section 3.4, Marine Flora and Fauna, of the EA.

Please forward any comments on the Draft EA and your concurrence to me at the above address. Comments on the Draft EA will be needed by May 30, 2000. A determination of concurrence on the BA received by June 30, 2000 would be most appreciated. If you need additional information or have any questions, please feel free to contact me by phone at (360) 396-0927 or by e-mail at klerkh@efanw.navfac.navy.mil.

Sincerely,

Kimberly Kler

KIMBERLY KLER
Environmental Planner

Enclosure:
(1) Draft Environmental Assessment for ongoing and future operations at U.S. Navy Dabob Bay and Hood Canal Military Operating Areas

Copy to w/enclosure:
Bob Donnely, NMFS
Brent Norberg, NMFS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
North Pacific Coast Ecoregion
Western Washington Office
510 Desmond Drive SE, Suite 102
Lacey, Washington 98503
Phone: (360) 753-9440 Fax: (360) 753-9008

Ms. Kimberly Kler
Department of the Navy
Engineering Field Activity, Northwest
Naval Facilities Engineering Command
19917 7th Avenue N.E.
Poulsbo, WA 98370-7570

(FWS Reference #: 1-3-2000-I-1115)

This letter is in response to your letter, draft Environmental Assessment (EA) and Biological Assessment (BA) regarding the proposed Dabob Bay and Hood Canal Military Operations in Kitsap and Jefferson County, Washington. The letter was dated April 26, and received in our office on April 28.

The following issues need to be addressed prior to our concurrence with your effect determinations and also constitute our comments on the Environmental Assessment. As most of these issues are described in the EA and the BA, these comments are relevant to both documents:

1) Page 3-8 - The first line states that exhaust components have low solubility and the second sentence states that they would escape into atmosphere after being dissolved. This is contradictory.

2) Page 3-8 - Different hydrocarbons have different impacts. These should be discussed individually.

3) Page 3-10 - How long does it take to disperse these exhaust components from the area where it exceeds water quality criteria?

4) We recommend that monitoring of exhaust gas impacts to water quality be included as part of the proposed action. Water quality standards are being exceeded and site specific information is needed to assure that impacts are minimal. While the CFMETR study referenced in the EA provides some justification for your conclusions, site specific information, particularly for the larger torpedoes is needed.

5) Page 3-15 - Para. 3, Line 1 - Remove the word "temporarily". Substances are dispersed, not eliminated.

6) Page 3-16 - Rupture of a torpedo during an impact test is a "spill". It must be reported to appropriate authorities and cleaned up appropriately. This should be part of the protocol for this type of incident.

7) Page 3-19 - A BMP for retrieving devices containing heavy metals should be developed and/or their use should be reduced or eliminated.

8) Appendix C, Page 72-73 - While the described flight rules would reduce disturbance to bald eagles, we still believe that there would be disturbance to eagles from helicopters under the flight rules. We recommend adding a 200 m. lateral no-fly area around bald eagle nests to the flight rules. On page 72, mention is also made of low-level flights over Toandos Peninsula potentially disturbing eagles. It is not clear whether these flights still occur, since it would appear they are prohibited under current flight rules.

If you have any questions about these comments or responsibilities under the Endangered Species Act of 1973, as amended, please contact John Grettenberger of my staff at (360) 753-6044.

Sincerely,

Bobbi Barrera
acting

Gerry Jackson, Manager
Western Washington Office

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

June 7, 2001

Captain Michael H. Conaway
Department of the Navy
Engineering Field Activity, Northwest
Naval Facilities Engineering Command
19917 7th Avenue NE
Poulsbo, Washington 98370-7570

Attention: Kimberly Kler

Re: Section 7 Informal Consultation on the U.S. Navy Dabob Bay and Hood Canal Military Operating Areas and Essential Fish Habitat Consultation (NMFS No. WSB-00-227)

Dear Captain Conaway:

This correspondence is in response to your request for consultation under the Endangered Species Act (ESA). Additionally, this letter serves to meet the requirements for consultation under the Magnuson Stevens Fishery Conservation and Management Act (MSA).

Endangered Species Act

The National Marine Fisheries Service (NMFS) has reviewed the May 21, 2001 request for concurrence with your findings of "may affect, not likely to adversely affect" for the above referenced project. Your findings were in regard to the listing of Puget Sound chinook salmon (*Oncorhynchus tshawytscha*), Hood Canal summer chum salmon (*O. Keta*), Steller sea lion (*Eumetopias jubatus*) as Threatened, and humpback whale (*Megaptera novaeangiliae*) as Endangered under the ESA. This consultation with the Department of Navy (Navy) is conducted under section 7(a)(2) of the ESA, and its implementing regulations, 50 CFR Part 402.

NMFS concurs with your findings of "may affect, not likely to adversely affect," to either the species or the designated critical habitat, because of the reasons provided in your Biological Assessment (BA): 1) the area where the testing will be conducted is not critical habitat for either of the listed marine mammal; 2) surveys for listed marine mammals will be conducted prior to range testing and tests will be postponed until the listed marine mammals are absent; 3) the testing will be done in/over deep water where juvenile chinook and chum salmon are not expected to be present; 4) studies have documented that past activities of a similar nature have not detectably contributed to the contamination of the deepwater sediment; 5) other studies have shown that propellant from the torpedoes cannot be detected in the water column; 6) based on these studies there should not be any detectable impact to critical salmon habitat; and 7) the chances of detecting impacts to the nearshore environment (where the juvenile salmon can be found) is insignificant and discountable.

This concludes informal consultation on these actions in accordance with 50 CFR 402.14(b)(1). The U.S. Army Corps of Engineers(ACOE) must reinitiate this ESA consultation if: 1) new information reveals effects of the action that may affect listed species in a way not previously considered; 2) the action is modified in a manner that causes an effect to the listed species that was not previously considered; or 3) a new species is listed, or critical habitat designated, that may be affected by the identified action.

Essential Fish Habitat

Federal agencies are obligated, under Section 305 of the MSA (16 USC 1855(b)) and its implementing regulations (50 CFR 600), to consult with NMFS regarding actions that are authorized, funded, or undertaken by that agency, that may adversely affect Essential Fish Habitat (EFH). The MSA (§3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Furthermore, NMFS is required to provide the Federal agency with conservation recommendations which minimize the adverse effects of the project and conserve EFH. This consultation is based, in part, on information provided by the Federal agency and descriptions of EFH for Pacific coast groundfish, coastal pelagic species, and Pacific salmon contained in the Fishery Management Plans produced by the Pacific Fisheries Management Council.

The proposed action and action area are described in the BA. The action area includes habitats which have been designated as EFH for various life stages of 46 species of groundfish, 4 coastal pelagic species, and 3 species of Pacific salmon (Table 1). Information submitted by the Navy in the BA is sufficient for NMFS to conclude that the effects of the proposed action are transient, local, and of low intensity and are not likely to adversely affect EFH in the long-term. NMFS also believes that the conservation measures proposed as an integral part of the action would avert, minimize, or otherwise offset potential adverse impacts to designated EFH.

EFH Conservation Recommendations: The conservation measures that the Navy included as part of the proposed action are adequate to minimize the adverse impacts from this project to designated EFH for the species in Table 1. It is NMFS' understanding that the Navy intends to implement the proposed activity with these built-in conservation measures that minimize potential adverse effect to the maximum extent practicable. Consequently, NMFS has no additional conservation recommendations to make at this time.

Please note that the MSA (§305(b)(4)(B)) requires the Federal agency to provide a written response to NMFS' EFH conservation recommendations within 30 days of its receipt of this letter. However, since NMFS did not provide conservation recommendations for this action, a written response to this consultation is not necessary.

This concludes EFH consultation in accordance with the MSA and 50 CFR 600. The ACOE must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations (50 CFR 600.920(k)).

If you have questions regarding either the ESA or EFH consultation, please contact Robert Donnelly of the Washington State Habitat Branch Office at (206) 526-6117.

Sincerely,

Donna Darm
Acting Regional Administrator

-4-

Table 1. Species of fishes with designated EFH occurring in Puget Sound.

Groundfish Species	redstripe rockfish *S. proriger*	Dover sole *Microstomus pacificus*
spiny dogfish *Squalus acanthias*	rosethorn rockfish *S. helvomaculatus*	English sole *Parophrys vetulus*
big skate *Raja binoculata*	rosy rockfish *S. rosaceus*	flathead sole Hippoglossoides elassodon
California skate *Raja inornata*	rougheye rockfish *S. aleutianus*	petrale sole *Eopsetta jordani*
longnose skate *Raja rhina*	sharpchin rockfish *S. zacentrus*	rex sole *Glyptocephalus zachirus*
ratfish *Hydrolagus colliei*	splitnose rockfish *S. diploproa*	rock sole *Lepidopsetta bilineata*
Pacific cod *Gadus macrocephalus*	striptail rockfish *S. saxicola*	sand sole *Psettichthys melanostictus*
hake *Merluccius productus*	tiger rockfish *S. nigrocinctus*	starry flounder *Platichthys stellatus*
black rockfish *Sebastes melanops*	vermilion rockfish *S. miniatus*	arrowtooth flounder *Atheresthes stomias*
bocaccio *S. paucispinis*	yelloweye rockfish *S. ruberrimus*	
brown rockfish S. auriculatus	yellowtail rockfish S. flavidus	**Coastal Pelagic Species**
canary rockfish *S. pinniger*	shortspine thornyhead *Sebastolobus alascanus*	anchovy *Engraulis mordax*
China rockfish *S. nebulosus*	cabezon *Scorpaenichthys marmoratus*	Pacific sardine *Sardinops sagax*
copper rockfish *S. caurinus*	lingcod *Ophiodon elongatus*	Pacific mackerel *Scomber japonicus*
darkblotch rockfish *S. crameri*	kelp greenling *Hexagrammos decagrammus*	market squid *Loligo opalescens*
greenstriped rockfish *S. elongatus*	sablefish *Anoplopoma fimbria*	**Pacific Salmon Species**
Pacific ocean perch *S. alutus*	Pacific sanddab *Citharichthys sordidus*	chinook salmon *Oncorhychus tshawytscha*
quillback rockfish *S. maliger*	butter sole *Isopsetta isolepis*	coho salmon *O. kisutch*
redbanded rockfish *S. babcocki*	curlfin sole *Pleuronichthys decurrens*	Puget Sound pink salmon O. gorbuscha

United States Department of the Interior

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JUN 0 8 2001

Ms. Kimberly Kler
Department of the Navy
Engineering Field Activity, Northwest
Naval Facilities Engineering Command
19917 7th Avenue N.E.
Poulsbo, Washington 98370-7570

FWS Reference: 1-3-00-I-0115

Dear Ms. Kler:

This letter is in response to your cover letter and Biological Assessment (BA) for the Ongoing and Future Operations at U.S. Navy Dabob Bay and Hood Canal Military Operating Areas in Kitsap and Jefferson Counties, Washington. Your letter and BA, dated April 26, 2000, was received in our office on April 28, 2000. We reviewed the BA, and requested additional information and recommended changes to the action by letter dated June 6, 2000. We received a modified BA, dated May 21, 2001, on May 22, 2001.

You have requested concurrence with your determinations of "may affect, not likely to adversely affect" the bald eagle *(Haliaeetus leucocephalus)*, marbled murrelet (*Brachyramphus marmoratus*), and the bull trout (*Salvelinus confluentus*); and "no effect" to the northern spotted owl (*Strix occidentalis caurina*) in accordance with section 7(a)(2) of the Endangered Species Act of 1973, as amended (Act)(16 U.S.C. 1531 et seq.). You changed your determination for the marbled murrelet from a "no effect" to a "may affect, not likely to adversely affect" based on our phone conversation on May 30, 2001. The U.S. Fish and Wildlife Service concurs with your effect determinations. This concurrence is based on the low likelihood of bull trout presence in Dabob Bay and implementation of the conservation measures described in the BA.

This concludes informal consultation pursuant to 50 CFR 402.13. This project should be re-analyzed if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this consultation; if the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this consultation; and/or, if a new species is listed or critical habitat is designated that may be affected by this project.

that was not considered in this consultation; and/or, if a new species is listed or critical habitat is designated that may be affected by this project.

If you have further questions about this letter or your responsibilities under the Act, please contact John Grettenberger at (360) 753-6044.

Sincerely,

for

Ken S. Berg, Manager
Western Washington Office

cc: NMFS, Seattle (B. Donnelly)
WDFW R6

Appendix D

Battelle MSL Water Quality Report

CONCENTRATIONS OF METALS IN SEDIMENT AND WATER OF DABOB BAY

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1529 West Sequim Bay Road
Sequim, WA 98382

March 2001

Prepared for
NAVSEA
Undersea Warfare Center Division
under contract 41490

Battelle, Pacific Northwest Division
Richland, Washington 99352

EXECUTIVE SUMMARY

The Dabob Bay Range Complex (DBRC) has been in operation for many decades, and the Navy is planning to continue torpedo testing for several more decades. The environmental impacts that could result from operations of the DBRC are the accumulation of several heavy metals in the sediment, with possible release of these metals to the overlying water. The purpose of the study conducted by the Battelle Marine Sciences Laboratory (MSL) was to provide marine chemistry data that will meet the needs of the state and federal agencies that evaluate the potential environmental impacts associated with the adoption and implementation of an Operations and Management Plan. The MSL is approved by the Washington State Department of Ecology (WDOE), the U.S. Environmental Protection Agency (EPA), and the U.S. Navy for the type of field sampling and chemical analyses conducted in this study. The methods used for field sampling and chemical analyses are recognized and approved by state and federal agencies for conducting marine environmental studies in Puget Sound.

During January 2001, MSL collected surface sediment (0-2 cm) at 14 locations within the DBRC (Figure 1). Water samples were collected at two depths (1 m below the surface and 10 m above the bottom) at four locations (Figure 1). The sediment and water samples were analyzed for cadmium (Cd), copper (Cu), lithium (Li), lead (Pb), zinc (Zn), and zirconium (Zr) not because of environmental concern, but because they are specified in the DBRC Environmental Assessment. The sediment samples were also analyzed for grain size, total organic carbon (TOC), acid volatile sulfide (AVS), and simultaneously extracted metals (SEM). The quality control results for the chemical analyses indicate the results for analyses of metals met the data quality objectives (DQO) for accuracy and precision.

The sediment in the DBRC is fine grained (muddy), and the concentrations of the six metals are similar to those in muddy sediment from other nonurban bays in Puget Sound. Figure 2 compares the concentrations of Cd, Cu, Pb, and Zn in Dabob Bay sediment with those from other studies and the WDOE sediment standards. This comparison indicates these four metals are well below the state standards. There are no sediment standards for Li and Zr. However, these concentrations in Dabob Bay sediment are typical for sedimentary rock. (The Cd concentrations in Figure 2 were multiplied by 100 to adjust them to the range of other metals.)

The concentrations of total recoverable metals in the Dabob Bay water samples were relatively uniform and similar to the concentrations in nonurban areas of Puget Sound and the ocean. Figure 3 shows a comparison between the concentration of Cd, Cu, Pb, and Zn in Dabob Bay with Puget Sound, the Straits, the ocean, and WDOE marine chronic standards. The concentrations of these four metals are well below the state standards. The WDOE does not have standards for Li and Zr. However, Li was present at the same concentration as in the ocean, and Zr was four orders of magnitude below the lowest effect concentration for toxicity to aquatic organisms.

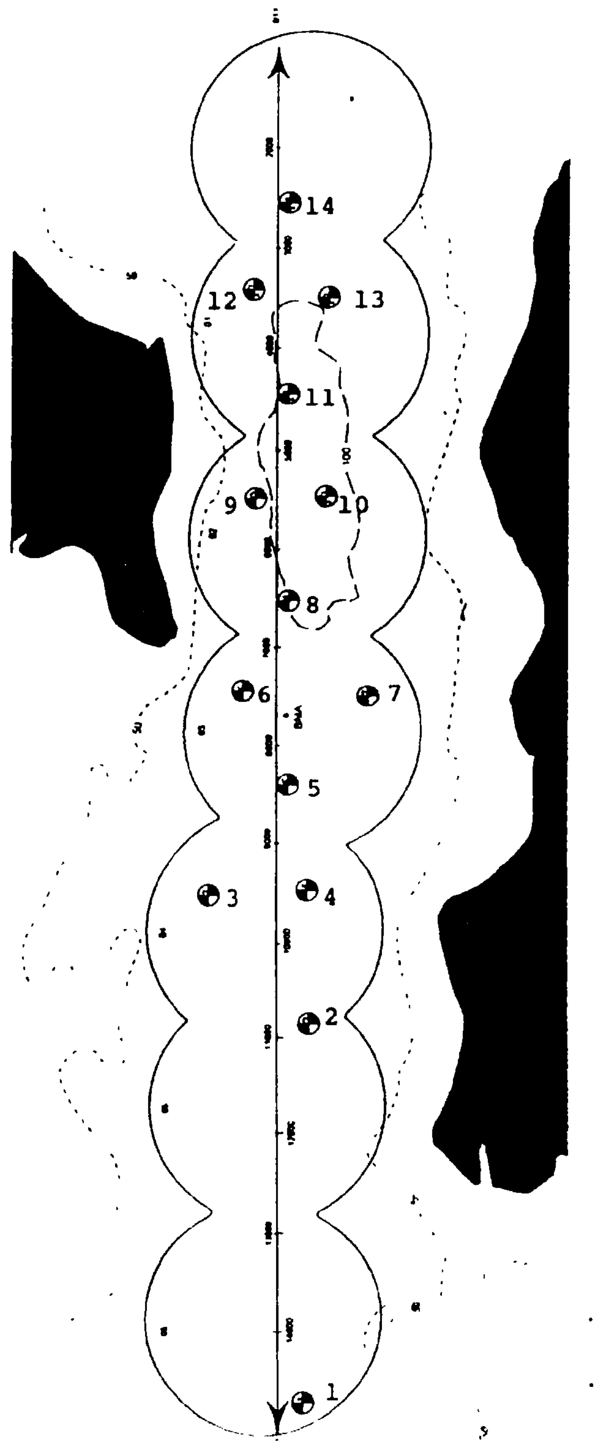

FIGURE 1. Location of the 14 sediment sampling stations in Dabob Bay. Seawater samples were collected at Stations 1, 5, 8, and 14. Depth contours are in fathoms.

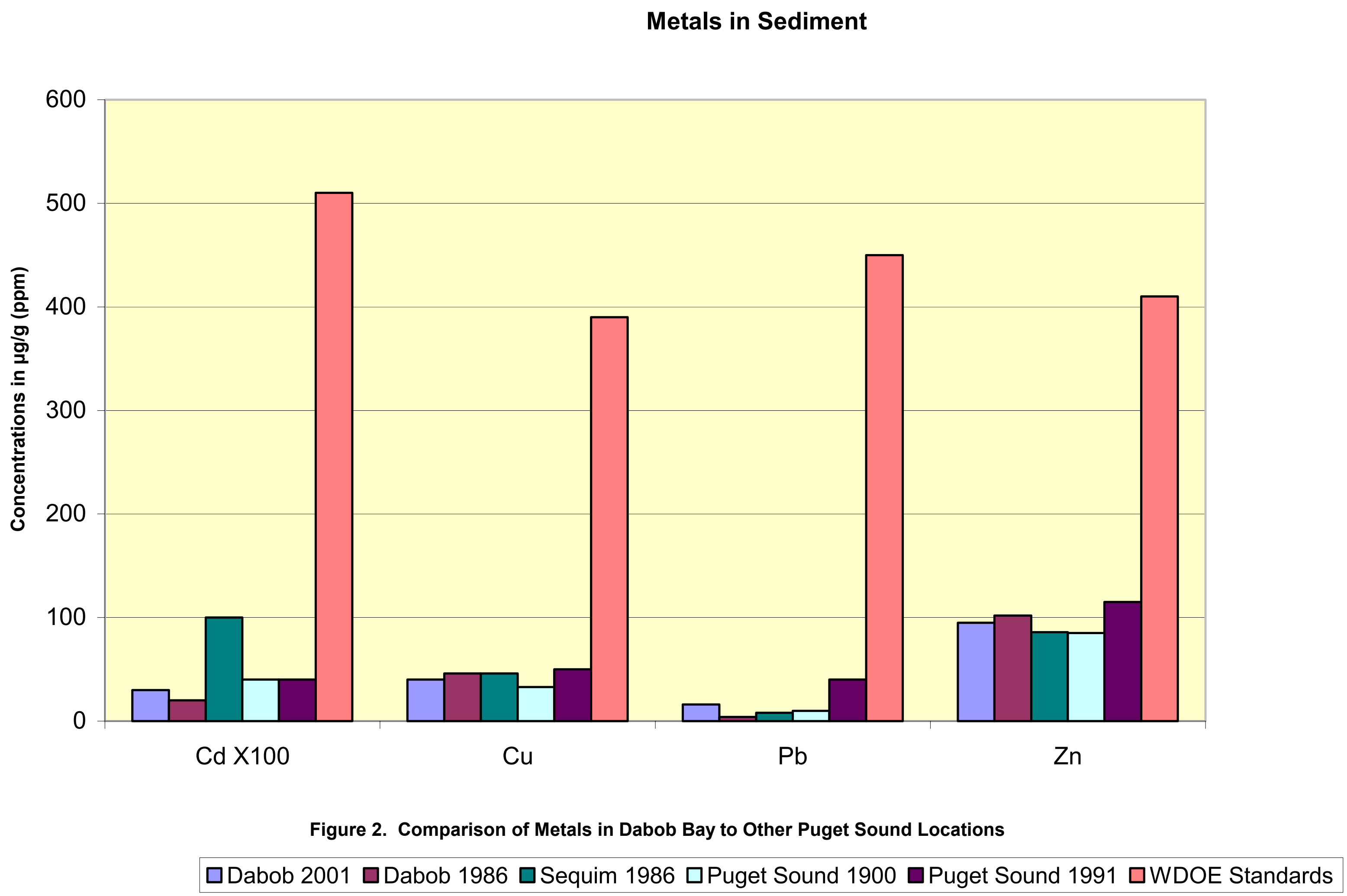

Figure 2. Comparison of Metals in Dabob Bay to Other Puget Sound Locations

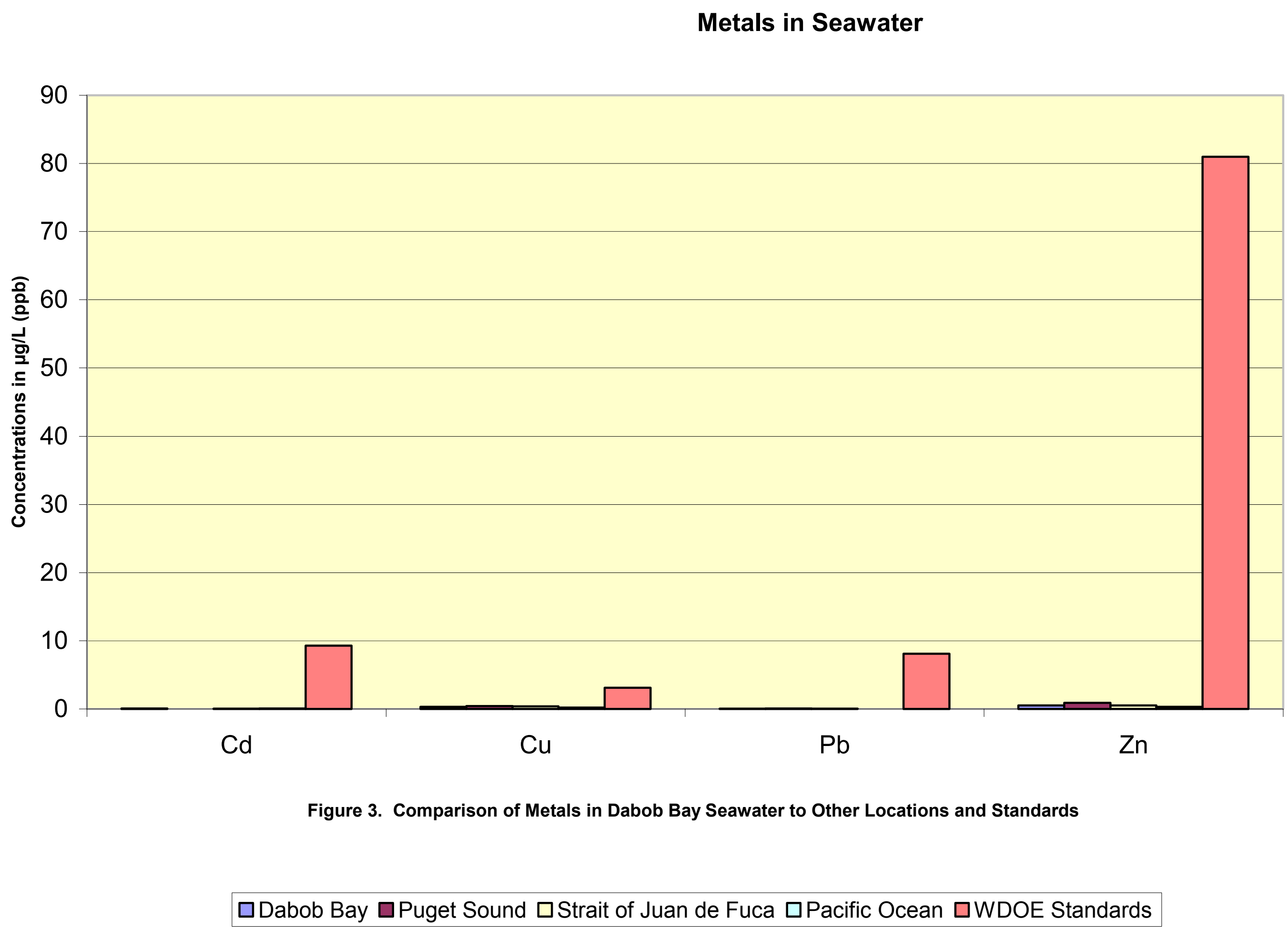

Figure 3. Comparison of Metals in Dabob Bay Seawater to Other Locations and Standards

CONTENTS

1.0 INTRODUCTION

The Dabob Bay Range Complex (DBRC) has been in operation for many decades, and the Navy is planning to continue torpedo testing for several more decades. The environmental impacts that could result from operations of the DBRC are the accumulation of several heavy metals in the sediment, with possible release of these metals to the overlying water. The purpose of the study conducted by the Battelle Marine Sciences Laboratory (MSL) was to provide marine chemistry data that will meet the needs of the state and federal agencies that evaluate the potential environmental impacts associated with the adoption and implementation of an Operations and Management Plan. The Battelle MSL is approved by the Washington State Department of Ecology (WDOE), U.S. Navy, and the U.S. Environmental Protection Agency (EPA) Oceans and Coastal Division (OCPD) for the field sampling and chemical analyses conducted in Dabob Bay.

Sediment and seawater samples were collected from Dabob Bay in January 2001. These samples were analyzed for heavy metals of concern (cadmium [Cd], copper [Cu], lithium [Li], lead [Pb], zinc [Zn], and zirconium [Zr]). These metals were chosen not because of environmental concern, but because they are specified in the DBRC Environmental Assessment. The concentrations of these metals in Dabob Bay were compared to WDOE sediment and water standards.

The EPA conducted a sediment quality survey of Dabob Bay in the mid-1980s (Strand et al. 1986). The results of the EPA survey indicated no chemical contamination and no sediment toxicity. These results were similar to those from other nonurban bays in Puget Sound including Case Inlet, Sammish Bay, and Sequim Bay. The locations of the sediment stations that the EPA sampled were not in the operations area of the DBRC, but generally in shallower water, and therefore, a direct comparison between the EPA study and the present study is not meaningful.

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2.0 METHODS

All field and laboratory methods used in this study are those recognized and used by the state and federal agencies that conducted environmental studies in Puget Sound. Many of these methods can be found in the Puget Sound Estuary Program (PSEP) protocols (PSEP 1996a, 1996b).

2.1 Navigation and Sampling Locations

Sampling stations were selected to sample the surface sediment layer (0-2 cm) from the central region of the DBRC. A total of 14 sediment sampling stations was selected, three around each of the four central hydrophone arrays and one from each of the northern end and southern end of the DBRC (Figure 1). Water samples were also collected at four of the sediment stations. Station positioning was determined by a global positioning system (GPS) provided by the DBRC navigation staff. The latitude and longitude were recorded at the time the sample was taken. A cable meter wheel determined water depth.

2.2 Sediment Sampling

Sediment samples were collected at 14 stations on January 25 and 26, 2001, using a 0.1-m^2 VanVeen grab sampler deployed from the MSL research vessel, *Strait Science*. The stainless steel grab sampler was equipped with doors that protected the undisturbed surface of the sediment. The upper two centimeters of the sediment was sampled and placed in plastic jars for the analysis of metals, grain size, and total organic carbon (TOC), and a glass jar was filled to the top to minimize contact with air to sample for acid volatile sulfide (AVS) and simultaneously extracted metals (SEM).

Water samples were collected at four stations, two stations near the center of the DBRC (Stations 5 and 8) and one on each end (Stations 1 and 14). At each of these four stations, a water sample was collected at 1 m below the sea surface and 10 m above the bottom, using a GoFlow water bottle that had been modified and acid-cleaned to minimize trace metal contamination. A plastic-coated hydro weight and plastic-coated messenger were used to minimize contamination. The seawater was transferred to precleaned polyethylene bottles, and separate bottles were filled for salinity analysis.

2.3 Analytical Methods for Metals and Conventionals

Sediment samples were freeze-dried then analyzed for metals (Cd, Cu, Li, Pb, Zn, and Zr) by inductively coupled plasma mass spectrometry (ICPMS) after complete digestion using nitric and hydrofluoric acids (NOAA 1998). Sediment samples were analyzed for grain size by Plumb's (1981) sieve and pipette method, for TOC by EPA Method 9060, for AVS by Allen et al. (1991), and SEM by EPA Method 6020 (ICPMS).

The University of Washington Marine Chemistry Laboratory analyzed seawater samples using a salinometer. The seawater samples that were collected for trace metals were acidified to pH 1.8 with high-purity nitric acid within several days after collection. The acidified seawater was allowed to equilibrate for at least 2 days after acidification before analysis for total recoverable metals. EPA Method 1640 (preconcentration followed by ICPMS analysis) was used to quantify Cd, Cu, Pb, Zn, and Zr. These metals were preconcentrated from seawater by reductive coprecipitation with iron and palladium. Li was quantified by ICPMS after a tenfold dilution of seawater with reagent water following EPA Method 1638.

2.4 Quality Control

Several types of quality control (QC) samples were analyzed to evaluate accuracy and precision for the analyses of metals in sediment and water.

2.4.1 Metals in Sediment

The QC results for the analysis of total recoverable metals in sediment are shown in Table 1. The results for the procedural blank are near or below the detection limit. The results for the laboratory duplicate analysis of sediment from Station 11 estimates the precision to be in the range of 0% to 9% relative percent difference (RPD). This is within the data quality objective of <25% RPD for duplicate analyses. The results for two marine sediment reference materials, Mag-1 and MESS-2, differ by 21% or less from the certified value, which is within the data quality objective (DQO) of <25% difference. The recovery results for a matrix spike (MS) and matrix spike duplicate (MSD) on Station 11 sediment range from 77% to 99%, which is within the DQO of 75% to 125% recovery. The RPDs for the two matrix spikes are well within the DQO of <25%.

2.4.2 AVS and SEM in Sediment

The QC results for AVS and SEM are presented in Table 2. The results are presented both in units of micromoles per gram (μ moles/g) and micrograms per gram (μg/g), because sulfide reacts with equal molar concentrations of certain metals that form metal sulfides, such as Cd, Cu, Pb, and Zn. The procedural blanks are relatively low compared with the concentrations in field samples. The reference sediment PACS-2 was analyzed for AVS and SEM as a laboratory control sample although it is not certified for these parameters, only for total metals. These results for PACS-2 are similar to our previous results for these elements. The MS for the SEMs was determined by spiking metals into the acid solution subsequent to the analysis AVS. The MS recoveries ranged from 88% to 103%.

2.4.3 Metals in Seawater

The QC results for the analysis of total recoverable metals in seawater are shown in Table 3. The results for the two procedural blanks contained detectable Cu, Pb, Zn, and Zr and undetectable Cd and Li. The mean blank for Cu, Pb, Zn, and Zr were used to blank correct the field data. A field duplicate sample was collected at the 1-m depth of Station 5. The RPDs for Pb, Zn, and Zr were greater than the DQO of <25%. However, the laboratory duplicate results were acceptable, except for those for Zr. The poor precision for Zr is because the concentration of Zr in the field samples is near the detection limit.

The results for the reference seawater CASS-4 are all acceptable. CASS-4 is not certified for Li and Zr, but for the other metals it is certified at concentrations similar to those in the Dabob Bay field samples, which makes CASS-4 an excellent reference material for these metals. The reference fresh water standard, 1643d, was analyzed for Li with good results. Li is present in seawater at a uniform concentration of 150 μg/L (Bruland 1983), which is similar to the concentration determined in Dabob Bay. The matrix spike recoveries for all metals were within the DQO.

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3.0 RESULTS

3.1 Sediment Conventional Properties

The location of the sediment stations, water depths, and conventional properties of the 14 sediment samples are listed in Table 4. Most of the stations are located in the deep and relatively flat central region of Dabob Bay. Therefore, it was expected that the sediment properties would be uniform. Only three stations, 1, 3, and 14, were shallower than 150 meters. Station 1 is located on the sill at the entrance to the bay. Station 3 is located on the western slope, and Station 14 is near the northern end of the DBRC. The grain size results indicate that only Station 3, which contains significant amounts of gravel and sand, is different from the other stations. The sediment from Station 3 contained clumps of hard, gray clay that may have been deposited by a submarine landslide or some other disturbance. The higher percentage of solids and lower TOC at Station 3 compared with those of the other stations are indicators that this station is unique for the area sampled. The grain size, percentage of solids, and TOC content of the other stations are typical of sediment in deep, quiet bays in Puget Sound.

3.2 Metals in Sediment

The concentrations of six metals in sediment samples are shown in Table 5. It is not surprising that the concentration range of each metal is relatively narrow, because the sediment composition is uniform, and apparently, there are no local pollution sources that cause gradients. Station 3 contains the lowest concentration of Cd, Cu, and Pb, which is a function of the grain size: coarse sediment has less surface area to adsorb metals than fine sediment.

3.3 AVS – SEM in Sediment

The concentrations of AVS and SEM are shown in Table 6. The AVS concentrations range from 0.01 to 36 μ mole/g. This wide range of result for AVS is surprising, considering the relatively narrow range in the physical properties of these sediments. However, the low AVS concentration for Station 3 could be expected because of the differences in grain size and TOC compared with those of other sediment samples. The color of the sediment samples was related to the AVS. The low AVS samples had a brown color, and the high AVS samples were black. Because the surface sediments in Dabob Bay were very soft and contained some burrows, the color and accordingly the AVS were heterogeneous. The results for SEM were relatively uniform across the 14 stations; results for Station 3 were the lowest. The SEM concentrations of Cd and Pb were approximately equal to the total concentrations in sediment.

3.4 Trace Metals in Seawater

The salinity and concentrations of six trace metals in the Dabob Bay seawater samples are shown in Table 7, along with the water sampling depths. Salinity values ranged from 27.4 $^{\circ}/_{\circ\circ}$ in the surface water at Station 1 to 30.66 $^{\circ}/_{\circ\circ}$ in the deepest sample from Station 8. These salinity values are consistent with historical salinity data from Dabob Bay and Hood Canal (Collias et al. 1974). The concentrations of the trace metals show little variation throughout the water samples. The slight differences in salinity are not likely to influence the concentrations of these metals. The concentration of suspended matter was not determined. However, the appearance of the surface water and the visual inspection of the water samples indicated there were no river plumes, nor plankton bloom, nor resuspended bottom sediment in the seawater samples. The slightly higher concentrations of Pb and Zr in the near-bottom water samples compared with those in the surface water samples could be due to increased concentration of suspended sediment. Because both Pb and Zr are associated with suspended matter in the water, an increase of 1 mg/L of suspended bottom sediment would increase the total recoverable concentration of Pb by 0.02 μg/L and Zn by 0.1 μg/L.

Because concentration of the reagents used in the preconcentrration and analysis procedure contributed significant amounts of Cu, Pb, Zn, and Zr, the procedural blanks for these four metals were subtracted from the field samples. The mean concentrations of the blanks are listed in Table 7. Except for Zr, the concentrations of the other five metals in the Dabob Bay water samples are similar to those reported for coastal and open ocean seawater. The matrix spike recoveries at a concentration of 2 μg/L were very good, which indicates that if Zr were near a concentration of 1 μg/L, the quantification would have been accurate.

4.0 DISCUSSION AND CONCLUSIONS

The primary purpose of this study was to determine whether the operation of the DBRC has had an adverse effect on sediment and water quality. Because small quantities of six metals could have been released by past DBRC activities, or may be released by future activities, the metals were examined. A comparison of concentrations of metals in Dabob Bay sediment and water with those in similar samples from other locations and with environmental standards makes it obvious that these six metals are not elevated in the DBRC.

Table 8 compares the concentrations of metals in sediments from this study with published data. In 1984, EPA Region 10 conducted a sediment quality study that included extensive chemical analysis of four sediment samples from several nonurban bays, including Dabob Bay and Sequim Bay (Strand et al. 1986). The EPA samples were collected outside the DBRC in shallower water with coarser sediment than were characteristic of areas sampled in the present study. The average results for four sediment samples from Dabob and Sequim Bay are shown in Table 8. Except for the lower Pb concentration that EPA reported for Dabob Bay, the other results are similar to those in the present study. However, because the EPA stations were outside the DBRC, a direct comparison cannot be used to detect temporal change.

Table 8 includes the concentrations of four metals in sediment deposited in central Puget Sound in the 1800s and in surface sediment collected in 1991. These preindustrial concentrations in central Puget Sound sediment are slightly lower for Cu, Pb, and Zn than present concentrations in Dabob Bay. However, Puget Sound surface sediment collected in 1991 contained higher concentrations of Cu, Pb, and Zn than in Dabob Bay. The concentration of the six metals in shale, a rock formed from mud, is included in Table 8, because there are no data for Li and Zr in Puget Sound sediment. Compared with concentrations in shale, Li and Zr are not apparently elevated in Dabab Bay sediment. The WDOE marine sediment standards for Cd, Cu, Pb, and Zn (Table 8), are much higher than the concentrations in Dabob Bay. There are no published sediment standards for Li or Zr.

The AVS concentrations in Dabob Bay sediment are primary in the range of 2 to 6 μ moles/g and therefore could detoxify >2 μ moles/g of metals that form insoluble metal sulfides such as Cd, Cu, Pb, and Zn. If the combined concentrations of SEM Cu and Zn exceeded 2 μ moles/g, then there would be the potential for soluble Cu and Zn to be released from the sediment. The SEM concentrations for Cu and Zn were approximately 0.4 and 0.6 μ mole/g, respectively, indicating that these concentrations would need to double before the sediment could become toxic. The concentrations of SEM Cd and Pb are much lower than Cu and Zn; therefore, these two metals are a minor competitor for the AVS. Three other metals that may compete for AVS are mercury, nickel, and silver. However, the concentrations of these metals are also relatively low in Dabob Bay sediment, based on the survey by Strand et al. (1986).

If the bottom water in Dabob Bay were contaminated with metals from equipment such as anchors, cables, and hydrophones, then there should be a significant increase in the concentrations of metals in the water samples collected near the bottom compared with those taken near the surface. This was not the case. There does not appear to be a significant difference with depth.

A comparison of the water concentrations of the six total recoverable metals determined in Dabob Bay with other published data for these metals in seawater is shown in Table 9. Dabob Bay concentrations are similar to those in other marine waters of Washington state and in the world's oceans. No Zr concentrations in coastal water are published, and there are no water quality standards for Li or Zr. There does not appear to be anthropogenic input of these six metals to Dabob Bay, and the concentrations are well below the WDOE marine chronic standard for dissolved Cd, Cu, Pb, and Zn shown in Table 9. The lowest effects level for Zr on aquatic life is approximately 1000 μg/L (Couture et al. 1989), which indicates the Zr concentration in Dabob Bay is of no concern.

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APPENDIX

Tables 1 – 9

Table 1. Quality Control Results for Metals in Surface Sediments (0-2cm)

	(concentrations in ug/g dry wt - not blank corrected					
	Cd	Cu	Li	Pb	Zn	Zr
Procedural Blank						
Blank 1	0.0327	0.101	3.4 U	0.1 U	0.7 U	3.3 U
Detection Limits	*0.02*	*0.2*	*3.4*	*0.1*	*0.7*	*3.3*
Laboratory Duplicate Results						
Station 11, rep 1	0.267	40.0	34.8	14.8	88.6	70.8
Station 11, rep 2	0.244	40.1	34.0	14.9	87.7	69.3
Mean	0.256	40.1	34.4	14.9	88.2	70.1
Relative percent difference	9%	0%	2%	1%	1%	2%
Standard Reference Material						
mag1	0.163	23.8	65.5	23.7	119	108
certified value	0.202	30	79	24	130	126
range	±0.029	±3	±4	±3	±6	±13
percent difference	19%	21%	17%	1%	8%	14%
MESS-2	0.252	37.1	76.3	20.9	140	NA
certified value	0.24	39.3	73.9	21.9	172	NC
range	±0.01	±2	±0.7	±1.2	±16	
percent difference	5%	6%	3%	5%	19%	NA

Table 1. Quality Control Results for Metals in Surface Sediments (0-2cm) - continued

	Cd	Cu	Li	Pb	Zn	Zr
	(concentrations in ug/g dry wt - not blank corrected					
Matrix Spike Results						
Amount Spiked	5.00	50.0	50.0	50.0	50.0	NS
Station 11 (mean)	0.255	40.1	34.4	14.8	88.2	NS
Station 11 MS	5.07	78.8	76.6	60.7	132	NS
Amount Recovered	4.82	38.7	42.2	45.9	43.8	NS
Percent Recovery	96%	77%	84%	92%	88%	NS
Amount Spiked	5.00	50.0	50.0	50.0	50.0	NS
Station 11 (mean)	0.255	40.1	34.4	14.8	88.2	NS
Station 11 MSD	5.18	78.4	74.4	61.0	133	NS
Amount Recovered	4.93	38.3	40.0	46.2	44.8	NS
Percent Recovery	99%	77%	80%	92%	90%	NS
Relative percent difference	2%	1%	5%	1%	2%	NA

U Not detected at or above DL shown
NA Not applicable/available
NC Not certified
NS Not spiked

Table 2. Quality Control Results for AVS-SEMs in Surface Sediments (0-2cm)

	AVS		SEM Cd		SEM Cu		SEM Pb		SEM Zn	
	(µg/g dw)	(µmole/g dw)	(µg/g dw)	(µmole/g dw)	(µg/g dw)	(µmole/g dw)	(µg/g dw)	(µmole/g dw)	(µg/g dw)	(µmole/g dw)
Procedural Blanks										
Blank 1	12.3 U	0	0.0497	0.000442	0.543	0.00855	0.161	0.00078	3.50	0.0536
Blank 2	12.3 U	0	0.0202	0.000180	0.324	0.00510	0.332	0.00160	0.761	0.0116
Standard Reference Material										
PACS 2, rep 1	475	14.8	1.86	0.0166	148	2.32	135	0.651	231	3.53
PACS 2, rep 2	445	13.9	1.96	0.0175	160	2.52	143	0.688	236	3.61
certified value	NC		2.11		310		183		364	
range			±0.15		±12		±8		±23	
percent difference	NA		12%		52%		26%		37%	
	NA		7%		48%		22%		35%	
Laboratory Duplicate Results										
Station 11	641	20.0	0.309	0.00275	18.4	0.289	13.6	0.0656	34.9	0.534
Station 11, Dup	764	23.8	0.252	0.00224	17.1	0.269	13.0	0.0628	34.0	0.520
Mean	702	21.9	0.280	0.00249	17.7	0.279	13.3	0.0642	34.4	0.527
RPD	17%	17%	20%	20%	7%	7%	4%	4%	3%	3%

Table 2. Quality Control Results for AVS-SEMs in Surface Sediments (0-2cm) - continued

	AVS		SEM Cd (µg/L)	SEM Cu (µg/L)	SEM Pb (µg/L)	SEM Zn (µg/L)
Post Spike Results (µg/L)						
Amount Spiked	NS	NS	25.0	25.0	25.0	25.0
Station 1	NS	NS	0.0819	3.49	2.49	8.83
Station 1 MS	NS	NS	25.9	26.9	27.7	32.2
Amount Recovered	NS	NS	25.8	23.4	25.2	23.4
Percent Recovery	NS	NS	103%	94%	101%	93%
Amount Spiked	NS	NS	25.0	25.0	25.0	25.0
Station 1	NS	NS	0.0819	3.49	2.49	8.83
Station 1 MSD	NS	NS	25.7	26.2	27.8	30.8
Amount Recovered	NS	NS	25.6	22.7	25.3	22.0
Percent Recovery	NS	NS	102%	91%	101%	88%
RPD	NA	NA	**1%**	**3%**	**0%**	**6%**

U Not detected at or above DL shown
NA Not applicable/available
NS Not spiked
NC Not certified
RPD Relative percent difference

Table 3. Quality Control Results for Metals in Unfiltered Seawater

	(concentrations in ug/L - blank corrected)					
	Cd	Cu	Li	Pb	Zn	Zr
Procedural Blanks						
Blank 1	0.006 U	0.113	1.9 U	0.0029	0.319	0.025
Blank 2	0.006 U	0.115	1.9 U	0.0018	0.329	0.027
Mean Blank	0.006 U	0.114	1.9 U	0.00235	0.324	0.026
Detection Limits	*0.006*	*0.12*	*1.9*	*0.006*	*0.3*	*0.13*
Field Duplicate Results						
Station 5 (1m)	0.0720	0.314	157	0.00776	0.394	0.13 U
Station 5 (1m) Dup	0.0692	0.370	148	0.0171	1.04	0.180
Mean	0.0706	0.342	153	0.0124	0.715	
Relative percent difference	4%	16%	6%	75%	90%	NA
Laboratory Duplicate Results						
Station 5 (176m) rep 1	0.0740	0.334	163	0.0319	0.566	0.210
Station 5 (176m) rep 2	0.0815	0.334	165	0.0311	0.572	0.152
Mean	0.0778	0.334	164	0.0315	0.569	0.181
Relative percent difference	10%	0%	1%	3%	1%	32%
Standard Reference Material						
CASS-4 r1	0.0244	0.592	NA	0.00846	0.416	NA
CASS-4 r2	0.0264	0.603	NA	0.0113	0.410	NA
certified value	0.026	0.592		0.0098	0.381	NC
range	±0.003	±0.06		±0.0036	±0.057	
percent difference	6%	0%	NA	14%	9%	NA
	2%	2%	NA	15%	8%	NA

Table 3. Quality Control Results for Metals in Unfiltered Seawater - continued

	(concentrations in ug/L - blank corrected)					
	Cd	Cu	Li	Pb	Zn	Zr
Standard Reference Material - cont.						
1643d r1	NA	NA	16.6	NA	NA	NA
1643d r2	NA	NA	18.1	NA	NA	NA
certified value			16.5			
range			±0.55			
percent difference	NA	NA	1%	NA	NA	NA
	NA	NA	10%	NA	NA	NA
Matrix Spike Results						
Amount Spiked	2.00	2.00	100	2.00	2.00	2.00
Station 5 (176m)	0.0778	0.334	164	0.0315	0.569	0.181
Station 5 (176m) MS	1.82	1.90	256	2.13	2.29	2.24
Amount Recovered	1.74	1.56	92.0	2.10	1.72	2.06
Percent Recovery	87%	78%	92%	105%	86%	103%
Amount Spiked	2.00	2.00	100	2.00	2.00	2.00
Station 5 (176m)	0.0778	0.334	164	0.0315	0.569	0.181
Station 5 (176m) MSD	1.83	1.91	251	2.14	2.50	2.25
Amount Recovered	1.75	1.57	87.0	2.11	1.93	2.07
Percent Recovery	88%	79%	87%	105%	96%	103%
Relative percent difference	1%	1%	6%	0%	12%	0%

U Not detected at or above DL shown
NA Not applicable/available
NC Not certified

Table 4. Station Locations and Surface Sediment (0-2cm) Conventional Properties

Station No.	Water Depth (m)	Lat. (N)	Long. (W)	Grain Size % Gravel	% Sand	% Silt	%Clay	Percent Solids	Percent TOC
1	120	47° 40' 21.5"	122° 51' 12.6"	0.00	1.08	48.44	50.48	28.9	2.09
2	154	47° 42' 06.5"	122° 50' 37.0"	0.04	0.37	49.74	49.84	28.2	2.31
3	124	47° 40' 59.5"	122° 51' 15.6"	5.74	21.33	58.25	14.67	47.1	1.25
4	182	47° 42' 52.3"	122° 50' 23.0"	0.00	0.26	46.02	53.71	28.2	2.50
5	186	47° 43' 14.6"	122° 50' 24.7"	0.00	0.20	37.96	61.85	25.9	2.47
6	195	47° 43' 51.4"	122° 50' 36.4"	0.12	0.28	35.41	64.19	13.6	2.70
7	176	47° 43' 42.2"	122° 49' 36.5"	0.07	0.43	42.80	56.70	24.0	2.51
8	193	47° 44' 05.1"	122° 50' 07.2"	0.00	0.33	39.05	60.62	20.8	2.51
9	185	47° 44' 47.6"	122° 50' 17.9"	0.00	2.46	38.93	58.61	24.2	2.44
10	193	47° 44' 37.5"	122° 49' 35.4"	0.00	0.51	39.40	60.09	18.0	2.63
11	193	47° 45' 16.1"	122° 49' 42.5"	0.00	0.28	35.74	63.97	20.4	2.76
12	190	47° 45' 46.5"	122° 50' 05.0"	0.00	0.35	34.45	65.21	19.5	2.66
13	188	47° 45' 37.0"	122° 49' 08.0"	0.00	0.43	38.81	60.75	22.8	2.54
14	78	47° 46' 10.3"	122° 49' 33.3"	0.00	0.23	34.48	65.29	23.9	2.49

<u>Table 5</u>. Concentrations of Metals in Surface Sediment (0-2cm)

Station No.	(concentrations in ug/g dry wt - not blank corrected					
	Cd	Cu	Li	Pb	Zn	Zr
1	0.300	35.3	30.9	15.0	91.0	84.2
2	0.259	38.7	28.2	16.1	92.4	80.0
3	0.174	33.8	28.6	10.7	94.2	76.5
4	0.298	43.0	36.4	17.0	98.7	81.7
5	0.264	45.3	37.2	18.7	101	80.5
6	0.286	45.3	34.7	16.0	97.1	73.7
7	0.290	39.4	30.6	15.8	91.7	79.1
8	0.239	41.2	35.6	18.5	98.0	78.4
9	0.341	46.2	34.8	18.4	101	80.8
10	0.187	37.7	32.0	15.4	87.6	74.5
11	0.267	40.0	34.8	14.8	88.6	70.8
12	0.233	39.5	27.6	14.4	86.6	70.5
13	0.249	39.4	27.0	17.2	92.9	78.8
14	0.260	40.0	31.4	17.0	94.8	76.4

Table 6. Concentrations of AVS-SEMs in Surface Sediment (0-2cm)

Station No	AVS		SEM Cd		SEM Cu		SEM Pb		SEM Zn	
	(µg/g dw)	(µmole/g dw)	(µg/g dw)	(µmole/g dw)	(µg/g dw)	(µmole/g dw)	(µg/g dw)	(µmole/g dw)	(µg/g dw)	(µmole/g dw)
1	201	6.28	0.391	0.00348	16.7	0.262	11.9	0.0574	42.1	0.645
2	185	5.76	0.256	0.00227	15.9	0.250	13.5	0.0649	35.1	0.537
3	0.338 U	0.0105	0.109	0.000971	10.7	0.168	9.04	0.0436	22.9	0.350
4	98.1	3.06	0.381	0.00339	19.5	0.308	16.9	0.0818	48.1	0.736
5	77.7	2.42	0.302	0.00269	18.9	0.297	16.9	0.0813	41.9	0.640
6	495	15.5	0.285	0.00254	19.4	0.305	15.5	0.0749	43.0	0.658
7	46.2	1.44	0.333	0.00296	18.4	0.289	13.8	0.0666	34.2	0.523
8	1160	36.2	0.462	0.00411	24.9	0.392	19.3	0.0933	56.6	0.865
9	763	23.8	0.328	0.00292	28.3	0.445	18.6	0.0899	51.6	0.790
10	261	8.14	0.146	0.00130	15.5	0.244	14.3	0.0690	34.0	0.521
11	641	20.0	0.309	0.00275	18.4	0.289	13.6	0.0656	34.9	0.534
11	764	23.8	0.252	0.00224	17.1	0.269	13.0	0.0628	34.0	0.520
12	118	3.67	0.364	0.00324	20.3	0.319	14.6	0.0705	39.5	0.604
13	884	27.6	0.248	0.00221	20.2	0.318	16.2	0.0780	38.9	0.595
14	63.5	1.98	0.225	0.00200	19.1	0.300	16.4	0.0793	41.1	0.628

U Not detected at or above DL shown

Table 7. Concentrations of Total Recoverable Metals in Unfiltered Seawater

Station No.	Sampling Depth (m)	Salinity ($^0/_{00}$)	(concentrations in ug/L - blank corrected					
			Cd	Cu	Li	Pb	Zn	Zr
1	1	27.442	0.0677	0.353	130	0.00966	0.374	0.0861
1	100	30.540	0.0715	0.320	148	0.0273	0.522	0.150
5	1	29.405	0.0720	0.314	157	0.00776	0.394	0.0941
5	176	30.655	0.0740	0.334	163	0.0319	0.566	0.184
8	1	29.237	0.0840	0.296	153	0.0127	0.976	0.0991
8	180	30.657	0.0727	0.311	155	0.0252	0.474	0.155
14	1	29.038	0.0694	0.340	148	0.0181	0.686	0.162
14	68	30.619	0.0721	0.322	152	0.0185	0.508	0.0771
Blank (used for blank correction)			0.006 U	0.114	1.9 U	0.0024	0.324	0.026

U Not detected at or above DL shown

Table 8. The Concentration of Metals in Dabob Bay Sediment Compared to Other Locations

Location	Concentrations in µg/g dry weight - Sediment					
	Cd	Cu	Li	Pb	Zn	Zr
Dabob Bay (This study)	0.3	40	35	16	95	80
Dabob Bay (Strand et al. 1986)	0.2	46	--	4	102	--
Sequim Bay (Strand et al. 1986)	1.0	46	--	8	86	--
Puget Sound Pre--1900 (Lefkovitz et al. 1997)	0.4	33	--	10	85	--
Puget Sound - 1991 (Lefkovitz et al. 1997)	0.4	50	--	40	115	--
Shale (Krauskoph 1967)	0.3	57	60	20	80	200
WDOE Sediment Standards	5.1	390	--	450	410	--

Table 9. The Concentration of Metals in Dabob Bay Seawater Compared to Other Locations

Location	Concentrations in µg/L - Unfiltered Seawater					
	Cd	Cu	Li	Pb	Zn	Zr
Dabob Bay (This study)	0.07	0.3	150	0.02	0.50	<0.2
Puget Sound (Paulson et al. 1989)	--	0.45	--	0.08	0.90	--
Straits of Georgia and Juan de Fuca (Paulson et al. 1989; Crecelius and Cullinan 1998)	0.05	0.4	--	0.03	0.50	--
World Ocean (Bruland, 1983)	0.07	0.2	150	0.01	0.30	--
WDOE Marine Chronic Standard for Dissolved Metals *(Zr estimated from Couture et al. 1989)	9.3	3.1	--	8.1	81	1000*

Appendix E

Correspondence

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 802/386-01
OCT 19 2001

Ms. Linda Rankin
Department of Ecology
Federal Consistency Coordinator
Shorelands and Water Resources Program
P.O. Box 47690
Olympia, WA 98504-7690

Dear Ms. Rankin:

This Coastal Consistency Determination (CCD) (Enclosure 1) is submitted in compliance with Subpart C of the National Oceanic and Atmospheric Administration (NOAA) Federal Consistency Regulations, 15 CFR 930.1 et seq. The proposed action is the adoption and implementation of an Operations and Management Plan (OMP) to regulate testing operations occurring in Dabob Bay in Jefferson County and Hood Canal in Kitsap and Jefferson Counties, Washington (33 CFR §334.1190). The shoreline permit process has not been initiated with either Kitsap or Jefferson County since the proposed action does not involve construction on State owned tidelands and the shore facilities are located on federally owned lands. The proposed action is consistent to the maximum extent practicable with the State of Washington Shoreline Management Act RCW 90.58 et seq., the Kitsap County Shoreline Management Master Program as adopted in July 1977, and amended March 1992 and the Jefferson County Shoreline Management Master Program, as adopted March 7, 1989, and amended February 1998.

The Proposed Action is the adoption and implementation of an OMP to regulate testing operations occurring in Dabob Bay and Hood Canal in Kitsap and Jefferson Counties, Washington. The OMP comprehensively describes all in-water testing activity at Dabob Bay, the two Hood Canal Military Operating Areas (MOAs) adjacent to Submarine Base Bangor and the connecting waters, and identifies estimates of testing intensity levels for each type of test. The Navy has no plans for installing any permanent tracking systems within the connecting waters or within the Hood Canal MOAs. No new shore facilities are proposed in the OMP.

The purpose of the proposed action is to provide an overarching comprehensive OMP and environmental analysis for ongoing and future operations in Dabob Bay, the two Hood Canal MOAs and connecting waters.

AGENCY DETERMINATION

(1) The proposed action and use of the property, operating areas, is in the interest of national defense, and if interpreted to be a non-conforming use it is grand-fathered in.

Subj: Coastal Consistency Determination

(2) An Environmental Assessment (Enclosure 2), in compliance with the National Environmental Policy Act, has been prepared and determined that no significant impacts will occur from implementation of the OMP. The Environmental Assessment was provided to the State and notice given to potentially interested stakeholders in April 2000.

(3) Pursuant to Section 307 of the Coastal Zone Management Act, the proposed action is consistent to the maximum extent practicable with the enforceable policies of approved State management programs.

Please provide a response within 5 working days after receipt of this letter.

If you have any further questions concerning this CCD, please feel free to contact Mr. Reinout van Beynum at (360) 396-5435 or e-mail: vanbeynu@kpt.nuwc.navy.mil.

Sincerely,

S. M. HERRON
Head, Safety, Security, Environmental
and Facilities Department
By direction

Encl: (1) Coastal Zone Consistency Determination for Federal Activities
(2) Dabob Bay Environmental Assessment

COASTAL ZONE CONSISTENCY DETERMINATION FOR FEDERAL ACTIVITIES

Project Description The adoption and implementation of the Operation and Management Plan (OMP) provides a comprehensive and consolidated environmental policy for ongoing and future operations at the Dabob Bay, Hood Canal Military Operating Areas (MOAs) and the connecting waters. The Navy has no plans for installing any permanent tracking systems within the connecting waters or within the Hood Canal MOAs. No new shore facilities are proposed in the OMP. The in-water testing programs described in the OMP and analyzed in an Environmental Assessment are divided into four types: research and experimental (R&E) (65% of all testing); proofing (15% of testing); fleet operations (15% of testing); and other operations (5% of testing). The types of testing activities described in the OMP have been ongoing since the 1960s in these operating areas. None of these tests involve explosive warheads, and explosive warheads are never placed on test units.

This action under CZMA §307(c)(1) is for a project which will take place within Washington's coastal zone, or which will affect a land use, water use, or natural resource of the coastal zone. *(The coastal zone includes Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Mason, Pacific, Pierce, San Juan, Skagit, Snohomish, Thurston, Wahkiakum and Whatcom counties.)*

The project complies with the following enforceable policies of the Coastal Zone Management Program (CZMP):

1. **Shoreline Management Act**:
   - Is outside of SMA jurisdiction (X)
   - Is under current SMA application ( )SMA # ________________ Date Issued_________
   - Has a valid Shoreline Permit ( )
   - Has received an SMA Exemption ( )
2. **State Water Quality Requirements:**
   - Does not impact water quality (X)
   - Is under current water quality application ( )
   - Has received a short-term modification of water quality standards ( ) Mod # _________________ Date Issued _________
   - Has received a 401 Certification ( ) 401# _________________ Date Issued ________
3. **State Air Quality Requirements:**
   - Does not impact air quality (X)
   - Is under current application for air permit ( )
   - Has received an air permit from the local air authority ( ) Air Permit # _____________ Date Issued ________
4. **State Environmental Policy Act:**
   - Project is SEPA exempt (X)
   - SEPA checklist submitted ( )
   - NEPA decision has been adopted by local government to satisfy SEPA SEPA # _________________ Date Issued ________ ( )
   - SEPA decision issued ( )

Therefore, I certify that this project is consistent to the maximum extent practicable with the enforceable policies of Washington's approved coastal zone management program.

(Signature) ______________________ Date 10/19/01

Enclosure (1)

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
P.O. Box 47600 • Olympia, Washington 98504-7600
(360) 407-6000 • TDD Only (Hearing Impaired) (360) 407-6006

December 10, 2001

Mr. S. M. Herron
Head, Safety, Security, Environmental/Facilities
Naval Undersea Warfare Center Division
610 Dowell Street
Keyport, WA 98345-7610

RE: Federal Consistency
Adoption and Implementation of an Operations and Management Plan

Dear Mr. Herron:

The Department of Ecology, Shorelands and Environmental Assistance Program received your Coastal Zone Consistency Determination for adoption and implementation of an Operations and Management Plan to regulate testing operations occurring in Dabob Bay in Jefferson County and Hood Canal in Kitsap and Jefferson Counties, Washington.

Upon review of this proposal, Ecology agrees with your determination and assessment that the proposed action is consistent to the maximum extent practicable with the enforceable policies of Washington's Coastal Zone Management Program and will not result in any significant impacts to the State's coastal resources.

If you have any questions regarding this letter please contact Linda Rankin our federal consistency specialist at (360) 407-6527.

Sincerely,

Gordon White

Gordon White
Program Manager
Shorelands and Environmental Assistance Program